Summit® WM Technical Reference Guide Software Version 5.3

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About this guide

This guide describes how to install, configure, and manage Extreme Networks® Summit® WM Controller, Altitude™ Access Points, and WM software.

Who should use this guide

This guide is a reference for system administrators who install and manage the Summit WM Controller, Access Points, and WM software system.

Any administrator performing tasks described in this guide must have an account with full administrative privileges.

What is in this guide

This guide contains the following chapters:

- "About this guide" describes the target audience and content of the guide, the formatting conventions used in it, and how to provide feedback on the guide.
- Chapter 1, "System Capacities" describes the supported limits and capacities of the Summit WM Controller software system.
- Chapter 2, "Configuration of Dynamic Host Configuration Protocol (DHCP)" describes the configurations the Wireless AP uses to identify which Summit WM Controllers are available to provide service in it's local area.
- Chapter 3, "Rogue Access Point Detection" describes the Summit WM Controllers' capabilities that allow Wireless APs to periodically scan the RF space and report suspect devices.
- Chapter 4, "Creating the Windows Security Infrastructure" provides the information necessary for the Deployment of Intranet Wireless.
- Chapter 5, "Windows Recommendations and Best Practices" provides recommendations and best practices for deploying an IEEE 802.11 WLAN in a large enterprise.
- Chapter 6, "Summit WM Controller diagnostics" provides information on hardware constraints and system diagnostics.
- Chapter 7, "Hardware maintenance" provides hardware descriptions and maintenance information.
- Chapter 8, "Altitude AP antenna selection" provides information on the antennas that can be used by each radio for the Wireless 802.11n AP model 3610
- Chapter 9, "AP as 802.1X supplicant" provides information on the 802.1X authentication protocol.
- Chapter 10, "MAC-Based Authentication" provides information on controlling access to the network resources for the wireless clients over the Summit WM Software system.
- Chapter 11, "FreeRADIUS and Security"provides information on FreeRADIUS options for RADIUS authentication and accounting.
- Chapter 12, "RADIUS Attributes" provides a reference list of the RADIUS Attributes that are supported by the Summit WM Controller, Access Points, and WM software.

- Chapter 13, "Availability and session availability" provides information on the availability feature, which maintains service availability in the event of a Summit WM Controller outage
- Chapter 14, "SNMP MIBs" provides a reference to the subset of MIB-II, as well as proprietary MIBs used in the repository of configuration and statistical data.
- Chapter 15, "DRM – Dynamic Radio Management" provides information on DRM and the Summit WM Software system.
- Chapter 16, "Call Admission Controls, TSPEC, and QoS" provides information on how Summit WM WLAN supports TSPEC as related to the 802.11e standard.
- Chapter 17, "Portable and text editable backup" provides information on the portable and text editable backup file feature.
- Chapter 18, "Logs and Events" provides a reference list of the log and event messages.
- Chapter 19, "Reference lists of standards" provides a reference list of RFCs supported.
- "Glossary" provides a list of acronyms used throughout this document.

Formatting conventions

The Summit WM Controller, Access Points, and WM software documentation uses the following formatting conventions to make it easier to find information and follow procedures:

- **Bold** text is used to identify components of the management interface, such as menu items and section of pages, as well as the names of buttons and text boxes.

  For example: Click **Logout**.
- `Monospace` font is used in code examples and to indicate text that you type.

  For example: Type `https://<wm-address>[:mgmt-port>]`
- The following symbols are used to draw your attention to additional information:

NOTE

Notes identify useful information, such as reminders, tips, or other ways to perform a task.

CAUTION

Cautionary notes identify essential information, which if ignored can adversely affect the operation of your equipment or software.

WARNING!

Warning notes identify essential information, which if ignored can lead to personal injury or harm.

Documentation feedback

If you have any problems using this document, please contact your next level of support:

- Extreme Networks employees should contact the interactive Customer Engagement Team (i-CET).
- Customers should contact the Extreme Networks Customer Support Center.

When you call, please have the following information ready. This will help us to identify the document that you are referring to.

- Title: *Summit WM Technical Reference Guide, Software Version 5.3*
- Part Number: 120483-00 Rev 01

Protocols and standards

Chapter 19, "Reference lists of standards" lists the protocols and standards supported by the Summit WM Controller, Access Points, and WM software. These lists include the Requests for Comment (RFCs) of the Internet Engineering Task Force (IETF) and the 802.11 standards developed by the Institute of Electrical and Electronics Engineers (IEEE).

1 System Capacities

This chapter provides the supported limits and capacities of the Summit WM Controller software system.

Summit WM Controller WM20/WM200/2000

The following table specifies the performance capacities of the Summit WM Controller WM20/WM200/2000 platforms.

Table 1: Summit WM Controller WM20/WM200/2000 system capacities

Limit	WM2000	WM200	WM20
Max # of APs	200	100	32
Max throughput	2 Gbits/sec	2 Gbits/sec	400 Mbps
Max # of users (single controller)	4096	2048	512
Max # of users (multi-box/reserved)	4096	2048	512
Max # of VoIP calls	500	200	61-77 (G.711 at 20 ms)
Max # of WM-AD	64	32	8
Max # of routes	Total 10 000 routes	Total 5000 routes	Total 600 routes
Max # of static routes	1000	500	100
Max # of dynamic learnt routes	9000	4500	500
Max # of admin users	5	5	5
Max # of filter groups or filter definitions	512	512	64
Max # of filter rules per group	128	128	64
Max# of total filter rules	60000	60000	16000
Max# routed VLANs	4	4	2
Max # of QoS profiles	128	64	16

Summit WM Controller WM100/WM1000

The following table specifies the performance capacities of the Summit WM Controller WM100/WM1000 platforms.

Table 2: Summit WM Controller WM100/WM1000 system capacities

Limit	WM1000	WM100
Max # of APs	200	75
Max throughput	2 Gbits/sec	400 Mbits/sec

Table 2: Summit WM Controller WM100/WM1000 system capacities (Continued)

Limit	WM1000	WM100
Max # of users (single controller)	4096	2048
Max # of users (multi-box/reserved)	4096	2048
Max # of VoIP calls	500	61-77
Max # of WM-AD	50	32
Max # of routes	10000	5000
Max # static routes	500	500
Max # dynamic learnt routes	9500	4500
Max # of admin users	5	5
Max # of filter rules per group	128	128
Max # of filter groups or filter definitions	512	512
Max# of total filter rules	16000	16000

Altitude Access Point

The following table specifies the performance capacities of the Altitude™ APs.

Table 3: Altitude AP system capacities

Limit	450/451	Outdoor AP (2650/2660)	350-2i/350-2d
Max # 802.11 user associations per radio	127	127	127
Max # simultaneous transmissions per radio (open, WEP, AES)	112	112	112
Max # simultaneous transmissions per radio (TKIP) (*See note below)	112	112	V3.x: 16 V4.x-V5R1: 24 V5R3: 112
Max throughput per radio type Wired to Wireless	11b=6 11g=26 11a=26 11a/n=147 11g/n=147	11b=6 11g=26 11a=26	11b = 6 Mbits/sec 11g = 26 Mbits/sec 11a = 26 Mbits/sec
Max throughput per radio type Wireless to Wired	11b=6 11g=24 11a=24 11a/n=144 11g/n=144	11b=6 11g=24 11a=24	11b = 6 Mbits/sec 11g = 24 Mbits/sec 11a = 24 Mbits/sec
Max # of SSIDs per radio	8	8	8
Max # MAC ACLs per AP	768	768	768
Max voice calls per radio Wireless to wireless	11b=4	11b=4	11b=10 11b/g/a=34

Table 3: Altitude AP system capacities (Continued)

Limit	450/451	Outdoor AP (2650/2660)	350-2i/350-2d
Max voice calls per radio Wireless to wired	11b=8	11b=8	11b=10 11b/g/a=34

NOTE

The maximum number of simultaneous transmissions per radio (TKIP) limits are version-dependent as follows:

- *V3.x – Maximum 16 TKIP clients, maximum 112 WEP/AES/none*
- *V4.x/V5R0/V5R1– Maximum 24 TKIP clients, maximum 112 WEP/AES/none0149*
- *V5R3 – Maximum 112 TKIP/WEP/AES/none clients*

Feature capacities

Mobility

Table 4: Mobility capacities

Limit	Value	Comments
Max. # of Summit WM Controllers per mobility domain	12 (1 Manager + 11 Agents)	Mobility domains can consist of WM100/WM1000/ WM20/WM200/2000 platforms.
Max. # of systems roamed	4096 – WM1000/WM2000 2048 – WM100/WM200 512 - WM20	Each respective platform can accept only an equal amount of users equivalent to its local capacity.
Max. # of aggregated mobility bandwidth	1Gbps – WM1000, WM200/ 2000 100 Mbps – WM100 200 Mbps - WM20	The maximum aggregated bandwidth is dependent on the bandwidth of the physical interface on which the inter-controller tunnel link is being established. Note: In most cases the interface bandwidth is being shared with other system operations (such as AP tunnelling aggregation).

Availability

Table 5: Availability capacities

Limit	Values	Platforms
Max # systems per availability cluster	2	Availability feature is supported in paired mode.
Max # APs per failover	200	WM1000/WM200/WM2000 Note:Failover limit is limited by the capacity of the controller category in question
	75	WM100
	32	WM20

Table 5: Availability capacities (Continued)

Limit	Values	Platforms
Session availability failover	less than 5 seconds	WM200/WM2000
failover time	200 APs – 2 Minutes	WM1000/WM200/WM2000
	75 APs – 1 Minute	WM100/WM200
Max # users per failover	4096	WM1000/WM2000 Note: Failover users capacity is restricted to the number of Local users capacity of the system undertaking the failover.
	2048	WM100/WM200
	512	WM20

Maximum failover capacity matrix

Table 6: Failover capacity matrix

Platforms	WM100	WM1000	WM20	WM200	WM2000	Local Capacity
WM100	75	75	32	75	75	75
WM1000	75	200	32	100	200	200
WM20	32	32	32	32	32	32
WM200	75	200	32	100	200	100
WM2000	75	200	32	100	200	200

Table 7: Legend

	Legend
Yes	All Summit WM Controllers within the same release (V5 R3).
Conditional	Number of APs allowed in failover is restricted by platform capacity.

2 Configuration of Dynamic Host Configuration Protocol (DHCP)

Wireless AP Discovery supports the following methods:

- Service Location Protocol (SLP)
- Domain Name Server (DNS) – ext-summitwm-connect-1.<domainname>
- Multicast – Same subnet multicast discovery

The listed discovery methods are tried in succession until a method is identified which produces a successful registration with a controller. Static configuration can also be used for Wireless AP registration. The static definition overrides any of the dynamic discovery methods.

For the Wireless AP's process to discover the Summit WM Controller, the Summit WM Controller, Access Points, and WM software system relies on a DHCP server that supports Option 78 and 79 for Service Location Protocol (SLP). The combination of Dynamic Host Configuration Protocol (DHCP), Option 78 and 79, and SLP provide a technique that defines the Summit WM Controller as the only element on the network that the Wireless AP can communicate with.

Option 78 is a list of IP addresses of Directory Agents, used by Service Agents and Users Agents.

Option 79 is an identifier that refers to a set of services called a scope. If a User Agent is assigned to a scope, it can only see the services in that scope, limiting the IP addresses of Directory Agents available to the User Agent.

SLP assisted Wireless AP registration includes the following:

- The Summit WM Controller Manager or the Wireless AP Manager use the Service Agent:
  - to look up the location of the Directory Agent using Option 78 and Option 79 in the DHCP server
  - to register with the Directory Agent
- The Wireless AP User Agent looks up the location of the Directory Agent using Option 78 and Option 79 in the DHCP server.
- The Wireless AP User Agent contacts the Directory Agent for services of the types "Extreme".
- The Wireless AP attempts to connect with the Summit WM Controller or Wireless AP Manager.

Through discovery the Wireless AP identifies which Summit WM Controllers are available in it's local area to provide service. The Wireless AP then registers with the Summit WM Controller using the CTP protocol, a proprietary UDP based control, provisioning and tunneling protocol.

NOTE

SLP may also be used for inter-controller discovery, and in support of the inter-controller mobility feature.

Service Location Protocol (SLP) (RFC2608)

Service Location Protocol (RFC2608) is a method of organizing and locating the resources (such as printers, disk drives, databases, e-mail directories, and schedulers) in a network. Using SLP, networking applications can discover the existence, location and configuration of networked devices.

In larger installations, services will register their services with one or more Directory Agents, and clients will contact the Directory Agent to fulfill requests for Service Location information.

Service Location Protocol consists of three cooperating services:

- **User Agent (UA)** – A process working on the user's behalf to acquire service attributes and configuration. The User Agent retrieves service information from the Service Agents or Directory Agents.
- **Service Agent (SA)** –A process working on the behalf of one or more services to advertise service attributes and configuration.
- **Directory Agent (DA)** – A process which collects information from Service Agents to provide a single repository of service information in order to centralize it for efficient access by User Agents. There can only be one DA present per given host.

When a service starts on the network, its Service Agent queries the DHCP server for Option 78 and Option 79 and registers itself appropriately.

DHCP Options for Service Location Protocol (RFC2610)

The Dynamic Host Configuration Protocol (RFC2131) provides a framework for passing configuration information to hosts on a TCP/IP network.

Entities using the Service Location Protocol, Version 2 (RFC2608) and Service Location Protocol, Version 1 (RFC2165) must obtain the address of Directory Agents in order to transact messages. The SLP Directory Agent option (Option 78) described in "SLP Directory Agent Option (Option 78)" on page 18 is used to configure User Agents and Service Agents with the location of Directory Agents in the network.

The SLP Scope Option (Option 79) described in "SLP Service Scope Option (Option 79)" on page 19provides an assignment of scope for configuration of SLP User and Service Agents. This option takes precedence over both default and static scope configuration of SLP agents. A scope is a set of services, typically making up a logical administrative group.

SLP Directory Agent Option (Option 78)

The SLP Directory Agent Option 78 specifies a list of IP addresses for SLP Directory Agents. Directory Agents should be listed in order of preference. Summit WM Controllers register themselves as directory agents.

The Length value must include one for the Mandatory byte and include four for each Directory Agent address which follows. The address of the Directory Agent is given in network byte order. The Mandatory byte in the Directory Agent option can be set to 0 or 1. If set to 1, the SLP User Agent or

Service Agent so configured must not employ either active or passive multicast discovery of Directory Agents.

The Directory Agents listed in Option 78 must be configured with the a non-empty subset of the scope list that the Agent receiving the Directory Agent Option 78 is configured with.

SLP Service Scope Option (Option 79)

Services are grouped together using scopes. Scopes are strings that identify a set of services that form an administrative grouping. Service Agents (SAs) and Directory Agents (DAs) are always assigned a scope string.

A User Agent (UA) is normally assigned a scope string (in which case the User Agent can only discover that particular grouping of services). This allows a network administrator to provision services to users. The use of scopes also allows the administrator to scale SLP deployments to larger networks.

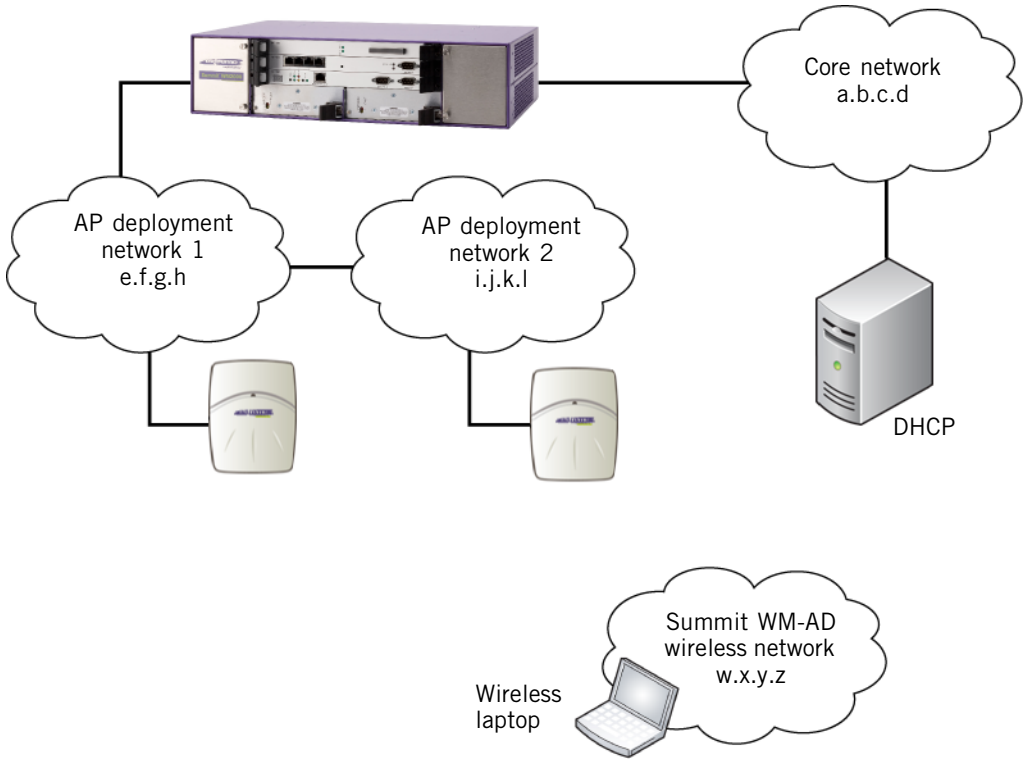
The Scope-List String is a comma-delimited list of the scopes that a SLP Agent is configured to use. The Length value must include one for the Mandatory byte. The Mandatory byte determines whether SLP Agents override their static configuration for scopes with the <Scope List> string provided by the option. This allows DHCP administrators to implement a policy of assigning a set of scopes to Agents for service provision.

If the Mandatory byte is 0, static configuration takes precedence over the DHCP provided scope list. If the Mandatory byte is 1, the <Scope List> provided in this option must be used by the SLP Agent. The Scope List String usage is defined in the SLPv2 specification (RFC2608).

Dynamic Host Configuration Protocol – Summit WM Controller and AP Discovery and other Services

Dynamic Host Configuration Protocol (DHCP) can be used for several purposes in a network configuration of a Summit WM Controller. Consider the following diagram:

Figure 1: DHCP in a Summit WM Controller system



This simple setup has the following properties:

- A Summit WM Controller connected to a core network segment (a.b.c.d),
- APs connected on both direct (e.f.g.h) and indirect (i.j.k.l) subnets,
- An existing DHCP server somewhere in the core segment, and
- Wireless users connected to a Summit WM Controller-controlled network (w.x.y.z).

In this setup there are four different areas in which DHCP must be considered:

Figure 2: Areas needing consideration for DHCP

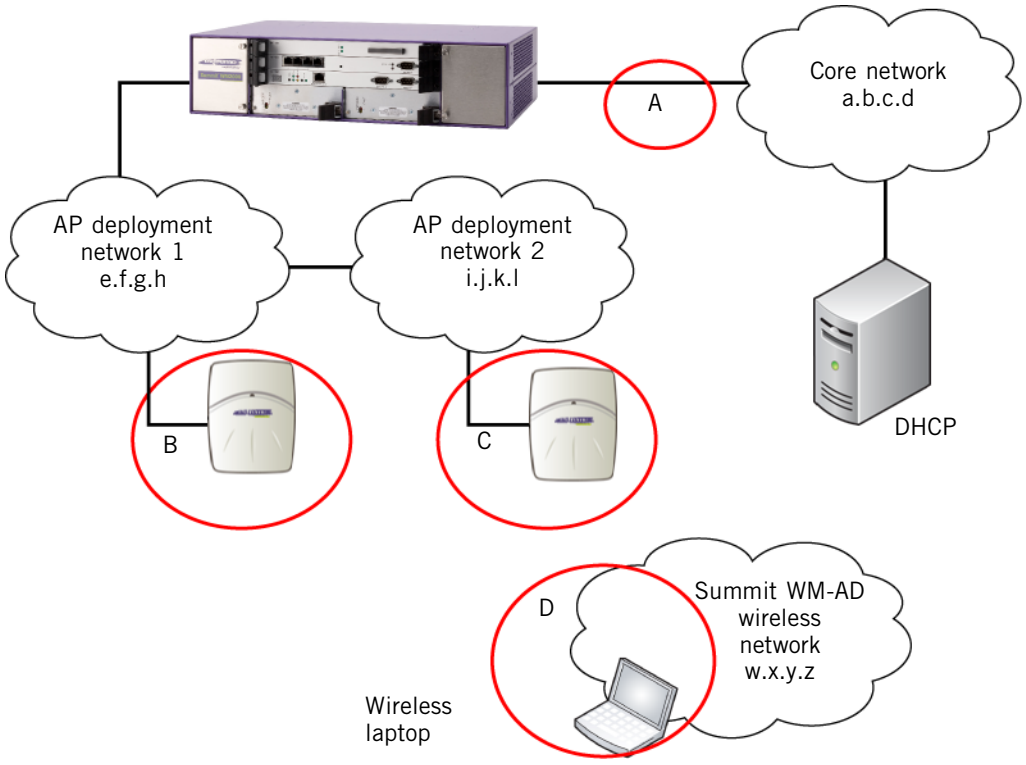


Table 8: Use of DHCP

Area	Description of use for DHCP
A	DHCP INFORM messages are periodically sent on all physical ports (esa0-1 on WM1000, esa0-3 on WM200/2000 Summit WM Controllers). DHCP INFORM messages are NOT requests for addressing on that segment. These messages use DHCP INFORM option 78 to provide information to other Summit WM Controllers deployed on the same segment. For setups that use multiple Summit WM Controllers a DHCP server in area A is required to answer requests for option 78 to allow availability and mobility to work. No addresses will be consumed. For a single Summit WM Controller setup a DHCP server in this area is not required. DHCP services for this area MUST be provided external to the Summit WM Controller.
B	In general APs that are used with the Summit WM Controller may use either a static or dynamically assigned IP address. For APs that are connected to the same subnet as the Summit WM Controller initial discovery can take place directly using multicast. However, the deployer of the APs may still wish to utilize DHCP addressing for the APs. Additionally, support for option 78 may be used in this area to aid in the initial discovery of the Summit WM Controller by the APs. DHCP services for this area MUST be provided external to the Summit WM Controller.

Table 8: Use of DHCP (Continued)

Area	Description of use for DHCP
C	For AP deployment networks that are not in the same subnet as the Summit WM Controller there needs to be some mechanism to allow the APs to find the Summit WM Controller across subnet. The APs can use a static list of Summit WM Controllers to connect to or use DNS but by far the most common method is to allow them to use DHCP option 78 to locate a service location protocol (SLP) director agent that is generally hosted on the Summit WM Controller itself.
	In addition, the APs themselves may also be addressed via DHCP in this area.
	DHCP services for this area MUST be provided external to the Summit WM Controller.
D	DHCP services in area D is for WLAN clients. A separate scope for each SSID is required.
	DHCP services for this area are provided by default by the Summit WM Controller. DHCP services can also be relayed to an external DHCP server.

DHCP setup using the internal DHCP server

For simple DHCP setups it is recommended to use the Summit WM Controller's built-in DHCP server. The internal DHCP server is intended to provide WLAN clients with IP addresses. The internal DHCP server settings are available in the Summit WM Graphical User Interface (GUI) under **WM-AD - Topology**. This page allows for the configuration of the following options for DHCP:

Table 9: Internal DHCP setup

Screen Item	Description
Gateway:	The user-configured IP address of the interface attachment on that subnet.
Mask:	The netmask for the network
Address range:	The overall range of available IP addresses. This has a default value based on the Gateway IP address.
Exclusions:	Any IP addresses to be excluded from the address range. Multiple entries are permitted.
Broadcast address:	The broadcast address. This value cannot be changed. It is automatically calculated.
Domain name:	The domain name to hand out to the client. If the domain name is wireless.aDRM.com and the client hostname is laptop then the FQDN for the client using this network will be laptop.wireless.aDRM.com.
Lease default:	The default lease time in seconds. The default is 36000 (10 hours).
Lease max:	The maximum lease time in seconds. The default is 2592000 (30 days).
DNS servers:	A single or list of DNS servers to give the DHCP client. Use a comma to separate multiple entries on this line.
WINS:	A single or multiple WINS servers to give the DHCP client. Use a comma to separate multiple entries

The major benefit of using the internal DHCP server is that all DHCP messages from clients are logged and available in the GUI under Logs & Traces - DHCP messages.

For the inclusion of options that are not supported within this layout it is recommend to use DHCP relay.

Using the Summit WM Controller as the default DHCP server

You can use the Summit WM Controller as the default DHCP server. This feature allows the controller to act as a DHCP server for the Altitude AP. The Summit WM Controller can also be used as a general DHCP server.

The Summit WM Controller's DHCP server is configured to ensure DHCP requests made to the esa ports are properly responded to. Each physical port can be configured separately.

When DCHP is enabled on a physical port, the DHCP options become available for configuration. (These options are identical to the DHCP options available to WM-ADs using the local DHCP server.)

Table 10: Summit WM Controller as default DHCP server

Screen Item	Description
Address range	The overall range of available IP addresses. This has a default value based on the IP address of the physical port.
Exclusions	Any IP addresses to be excluded from the address range. Multiple entries are permitted.
Range from	The start of a range of excluded IP addresses or a single IP address to be excluded.
Range to	The end of a range of excluded IP addresses. This is optional.
Comment	A comment about an exclusion range. This is optional.
Gateway	The default gateway. This has a default value based on the IP address of the physical port.
Broadcast address	The broadcast address. This value cannot be changed. It is automatically calculated.
Domain name	The domain name that Wireless APs will use for DNS Server's discovery. This is optional.
Lease	The time that an IP address will be allocated to a Wireless AP, measured in seconds.
Default	The time that an IP address will be allocated to a Wireless AP, measured in seconds.
Max	The maximum time that an IP address will be allocated to a Wireless AP, measured in seconds.
DNS servers	The DNS Server's IP address. This is optional.
WINS	The WINS Server's IP address. This is optional.

DHCP setups for relayed WM-AD's and AP deployment networks

Sometimes it is necessary to use a DHCP server external from the Summit WM Controller to offer DHCP addresses. Popular reasons for this are:

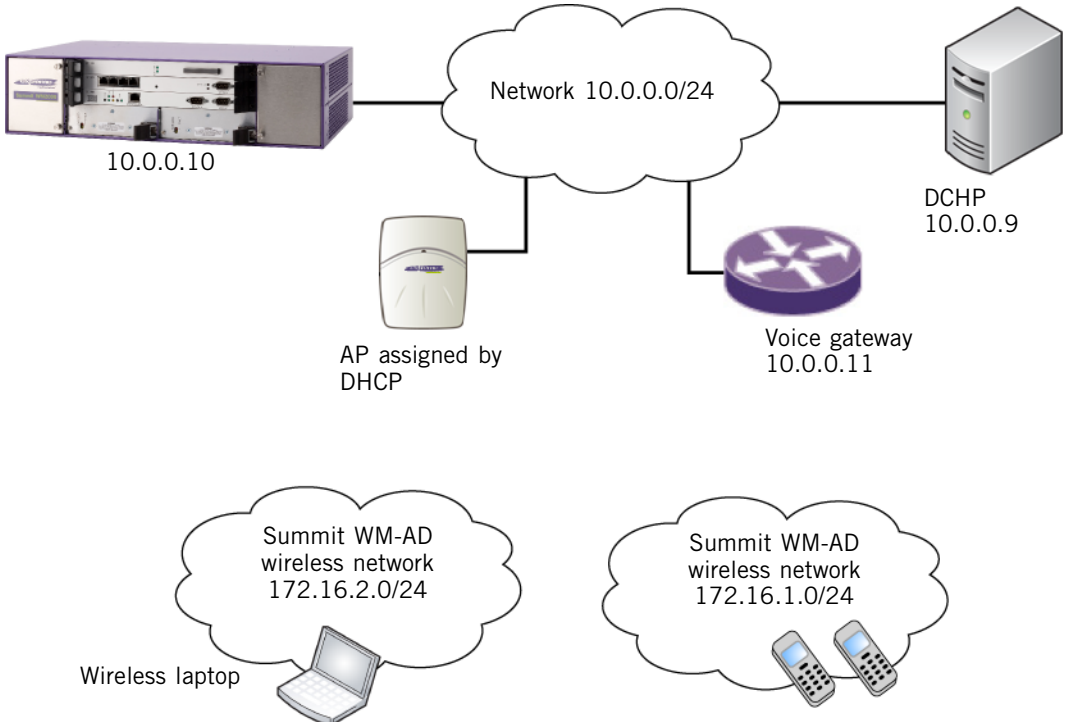
- Support for DHCP options that are not exposed through Summit WM Controller GUI (Summit WM GUI),
- To leverage existing DHCP infrastructures, and
- To consolidate the DHCP requirements for wireless client, APs, and the Summit WM Controller in one place.

The limitation of using DHCP relay comes in the logging of DHCP messages on the Summit WM Controller. When using DHCP relay the DHCP log under Logs & Traces → DHCP Messages is not populated with DHCP requests. It is assumed that for DHCP relay that the target DHCP server has its own logging mechanism.

DHCP configuration example: OSC dhcpd on Linux

Consider the following topology:

Figure 3: Topology for DHCP example



The Summit WM Controller is connected on network 10.0.0.0/24 as 10.0.0.10. Also on that network are a DHCP server, a voice gateway for phones, and all Access Points. The phones have the special property in that they require DHCP option 151 to find their voice gateway. Since the Summit WM Controller-built-in DHCP server does not support custom options is was decided to use a Linux server at 10.0.09 to host all DHCP requirements for this network. It is possible to configure each WM-AD to use DHCP relay to the example DHCP server of 10.0.0.9.

The following is the configuration file dhcpd.conf from the Linux server at 10.0.0.9:

Figure 4: dhcpd.conf example listing

```
1  authoritative;
2  ddns-update-style none;

3  option svp code 151 = ip-address ;

4  subnet 10.0.0.0 netmask 255.255.255.0 {
5        range 10.0.0.50 10.0.0.250;
6        option routers 10.0.0.10;
7        option slp-directory-agent true 10.0.0.10;
8  }

9  subnet 172.16.1.0 netmask 255.255.255.0 {
10       range 172.16.1.2 172.16.1.254;
11       option routers 172.16.1.1;
12       option domain-name "voice.company.com"
13       option domain-name-servers 10.0.0.9;
14       option svp 10.0.0.11;

15       default-lease-time 36000;
16       max-lease-time 2592000;
17       authoritative;
18 }

19 subnet 172.16.2.0 netmask 255.255.255.0 {
20       range 172.16.2.2 172.16.16.254;
21       option routers 172.22.246.1;
22       option domain-name "wlan.company.com"
23       option domain-name-servers 10.0.0.9;

24       default-lease-time 36000;
25       max-lease-time 2592000;
26       authoritative;
27 }
```

This file can be divided into the following four areas:

- General options: lines 1-3
- Scope for 10.0.0.0/24 subnet: lines 4-8
- Scope for 172.16.1.0/24 subnet (voice subnet): lines 9-18
- Scope for 172.16.2.0/24 subnet (laptop subnet): lines 19-27

General options

Line 1 designates this DHCP server as authoritative in case another DHCP server answers requests.

Line 2 sets options for Dynamic DNS. This option turns off DNS updates based upon DHCP mappings. There are other options that allow DHCP to update a DNS server to reflect the addresses handed out by the DHCP server. See the man page for dhcpd.conf for more information on support for this option.

Line 3 defines the format for DHCP option 151 as we want to use it. The phones being used on one of the wireless networks in this example require this option to find their voice gateway. Since the Summit WM Controller does not allow for custom options this is the perfect place to insert this option.

Scope 10.0.0.0/24 (lines 4-8)

This scope is primarily defined to allow APs deployed in the same subnet to acquire an IP address. Also defined in this subnet is the option slp-directory-agent – this is option number 78 and allows the APs to find the Summit WM Controller by Service Location Protocol. It also allows a multiple Summit WM Controller setup that includes availability and mobility.

Notice that the static addresses in the topology use host addresses whose last octet is less than 50. The definition in the file specifically will address APs only from address 50-254 within this subnet. Thus, the static addresses used by the infrastructure elements are protected from use by the DHCP-enabled APs.

Scope 172.16.1.0/24 (lines 9-18)

This scope is defined to address wireless handsets. Notice the use of option 151 (now called ‘svp’ within the scope). Delivery of this option would be impossible from the Summit WM Controller itself but it can be delivered through DHCP relay. The other options are self-explanatory.

Scope 172.16.2.0/24 (line 19-27)

This scope is defined to address general wireless devices using a separate SSID on the same system that the voice clients are deployed on. The options within this scope are very simple – see the dhcpd.conf and dhcpd-options man pages within Linux to review the variety of options that are available to be handed out to DHCP clients within your network.

Altitude Access Point Discovery mechanism

The following outlines an advanced version of our Altitude Access Point discovery mechanism. Note that this document only applies to the mechanism for discovering the IP address or addresses of the Summit WM Controller or set of Summit WM Controllers that may provide service to a particular Wireless AP. It does not include a description of or make any assumptions about the mechanism to “connect” to a Summit WM Controller or of any failover scenarios for Summit WM Controller connection.

Wireless AP DHCP Registration Setup (WINDOWS)

You can configure the DHCP service that is included with Windows 2000 and Windows 2003 to provide DHCP option 78. Extreme Networks Altitude APs (Wireless AP) as clients to the Summit WM Controller (Summit WM Controller) may require the configuration of DHCP options 78 for controller discovery. These options are sometimes referred to as the SLP options. The SLP options (from Request for Comments [rfc] 2610) have an extra flag in the option field that is different than any other DHCP option. This flag is called the Mandatory byte. No other DHCP options for simple address arrays follow this structure.

The following example compares SLP options to DCHP options:

SLP options:

```
| Code = 78 | Length | Mandatory | a1 | a2 | a3 | a4 |...
```

All other DHCP options:

```
| Code = 32 | Length | a1 | a2 | a3 | a4 |...
```

This extra 5th byte prevents you from using the IPAddress array type in the snap-in when you add this option. However, you can add the option by creating option 78 as a Byte array.

Create a New DHCP Scope and Configure Option 78

1 Start Programs Administrative Tools DHCP

2 <Right mouse click> Server or Superscope (if created and applicable) select **New Scope.**

NOTE

If you wish to use an existing scope and all that you wish to do is add the SLP option; <right mouse click> on the Scope Options of the related existing DHCP scope and proceed to Step 13.

3 The New Scope Wizard will appear <Next>

4 Enter **Name** and **Description** of the new scope for the Wireless AP's <**Next**>

5 *IP Address Range dialog;* select the **Start** and **End** points for your Wireless AP IPs and the associated **Subnet** in one of two ways **Bit Length** (ex. 24) or **Dotted Decimal** (ex. 255.255.255.0) <**Next**>.

6 *Add Exclusions* dialog; If applicable **Start** and **End** points for addresses within the created pool that need to retain the same IP address. <**Next**>

7 *Lease Duration* dialog; Lease times <**Next**>

8 *Configure DHCP Options* dialog; Select **Yes** <**Next**>

9 *Default Gateway* dialog; Self explanatory <**Next**>

10 *Domain Information* dialog; Self explanatory <**Next**>

11 *WINS Information* dialog; Self explanatory <**Next**>

12 *Activate Scope* dialog; **Yes** <**Next**>

13 Under the newly created **Scope** <right mouse> on **Scope Options** select **Configure Options**

14 *General Tab;* Select Option 78 SLP DA (Service Location Protocol Directory Agent) then enter the Mandatory byte "00" and the IP address <in Hexadecimal> of the Summit WM Controller ESA Port that will host the Wireless APs (this will be the ESA port with the SLP Option selected).

NOTE

It is also possible to attend to this using Dotted Decimal form.

For example, for the controller ESA Port IP address 10.53.0.1, additions should be made in hexadecimal format **00** <lead byte> **0A 35 00 01** <IP address>

For the sake of convenience a quick reference chart follows for the decimal to hexadecimal conversions.

Table 11: Decimal to Hexadecimal Conversions

Dec-Hex	Dec-Hex	Dec-Hex	Dec-Hex	Dec-Hex	Dec-Hex	Dec-Hex	Dec-Hex	Dec-Hex
0 - 00	31-1F	62-3E	93-5D	124-7C	155-9B	186-BA	217-D9	248-F8
1 - 01	32-20	63-3F	94-5E	125-7D	156-9C	187-BB	218-DA	249-F9
2 - 02	33-21	64-40	95-5F	126-7E	157-9D	188-BC	219-DB	250-FA
3 - 03	34-22	65-41	96-60	127-7F	158-9E	189-BD	220-DC	251-FB
4 - 04	35-23	66-42	97-61	128-80	159-9F	190-BE	221-DD	252-FC
5 - 05	36-24	67-43	98-62	129-81	160-A0	191-BF	222-DE	253-FD
6 - 06	37-25	68-44	99-63	130-82	161-A1	192-C0	223-DF	254-FE
7 - 07	38-26	69-45	100-64	131-83	162-A2	193-C1	224-E0	255-FF
8 - 08	39-27	70-46	101-65	132-84	163-A3	194-C2	225-E1	
9 - 09	40-28	71-47	102-66	133-85	164-A4	195-C3	226-E2	
10-0A	41-29	72-48	103-67	134-86	165-A5	196-C4	227-E3	
11-0B	42-2A	73-49	104-68	135-87	166-A6	197-C5	228-E4	
12-0C	43-2B	74-4A	105-69	136-88	167-A7	198-C6	229-E5	
13-0D	44-2C	75-4B	106-6A	137-89	168-A8	199-C7	230-E6	
14-0E	45-2D	76-4C	107-6B	138-8A	169-A9	200-C8	231-E7	
15-0F	46-2E	77-4D	108-6C	139-8B	170-AA	201-C9	232-E8	
16-10	47-2F	78-4E	109-6D	140-8C	171-AB	202-CA	233-E9	
1711	48-30	79-4F	110-6E	141-8D	172AC	203-CB	234-EA	
18-12	49-31	80-50	111-6F	142-8E	173-AD	204-CC	235-EB	
19-13	50-32	81-51	112-70	143-8F	174-AE	205-CD	236-EC	
20-14	51-33	82-52	113-71	144-90	175-AF	206-CE	237ED	
21-15	52-34	83-53	114-72	145-91	176-B0	207-CF	238-EE	
22-16	53-35	84-54	115-73	146-92	177-B1	208-D0	239-EF	
23-17	54-36	85-55	116-74	147-93	178-B2	209-D1	240-F0	
24-18	55-37	86-56	117-75	148-94	179-B3	210-D2	241-F1	
25-19	56-38	87-57	118-76	149-95	180-B4	211-D3	242-F2	
26-1A	57-39	88-58	119-77	150-96	181-B5	212-D4	243-F3	
27-1B	58-3A	89-59	120-78	151-97	182-B6	213-D5	244-F4	
28-1C	59-3B	90-5A	121-79	152-98	183-B7	214-D6	245-F5	
29-1D	60-3C	91-5B	122-7A	153-99	184-B8	215-D7	246-F6	
30-1E	61-3D	92-5C	123-7B	154-9A	185-B9	216-D8	247-F7	

DNS Settings for Altitude AP Discovery

There is an assumption that for the use of this mechanism that there are DNS services configured and available.

1 Start Programs Administrative Tools DNS

2 <Right mouse click> Domain that will be used for discovery, select **New Host** (W2K Server) **New Host (A)** (W2003 server)

3 First field enter **ext-summitwm-connect-1** which is the default name for the Extreme Networks Summit WM Controller, then enter the **IP address of the WM ESA port** that will host the Wireless AP connections.

4 Select **Create Pointer** <Finish>. This will create a pointer and **append the WM reference "ext-summitwm-connect-1" to the existing domain string** to create the host record and in turn the "Forward Lookup" for the Wireless APs to discover the Summit WM Controller.

Static Altitude AP Addressing

If an Altitude AP is configured to use a static IP address, it will always use the configured static IP address and will not use the default IP address.

- To configure a static IP address, power up the Altitude AP, connect the Altitude AP to a laptop, and then ping the Altitude AP's default IP address. You have approximately 60 seconds to establish a connection to the Altitude AP.
- If the ping is successful, telnet the Altitude AP and configure the static IP address of the Altitude AP.
- If the Altitude AP is not configured, the Altitude AP retains its default IP address and begins the discovery process. The Altitude AP will retain the default IP address until configured otherwise.

3 Rogue Access Point Detection

The rogue AP detection feature, Summit WM series Spy, provides capabilities to Summit WM Controllers that allow Wireless APs to periodically scan the RF space and report suspect devices. With this capability, Wireless APs can multitask as scan devices as well as access points. This allows rogue detection to occur without installing overlay sensor networks. Summit WM Controllers Rogue detection system is comprised of two major components; the Data Collector and the Analysis Engine.

The Data Collector runs on every Summit WM Controller and is responsible for initiating the rogue scans and compiling information received from all Wireless APs under its control.

The Analysis Engine is the brains of this feature and runs on one Summit WM Controller in the network. It polls all Data Collectors periodically (default is every 5 seconds) and analyzes the polled data to identify new devices. It also uses the polled data to build a table of known "friendly" Wireless APs and 3rd Party Access Points. On subsequent scans, new devices are identified and compared to the "friendly" list and differences are flagged as potential Rogues. The Analysis Engine also includes a GUI to allow users to manually add or remove devices from the system or redefine a device identified as a potential rogue into a "friendly" if the proper designation of a device is determined.

A Wireless AP is assigned to a "scan group" that has a particular set of "scan parameters. Different groups can be defined so that the administrator can assign Wireless AP's to logical groups to address either different geographic needs (that is, only scan certain buildings at certain times) or coverage issues (only scan with half of the Wireless APs in a given area at a given time). An Altitude AP can only be assigned to one group. The algorithms and mechanisms for RF scanning have been designed to minimize the impact on user data. Also, the GUI provides the ability for an administrator to configure the frequency at which the Wireless AP's within a scan group will initiate a scan (minimum 10 minutes, and maximum 120 minutes)

Upon completion of the scan, the Wireless AP will send back the results to the Summit WM Controller and then wait for the next "scan interval" to repeat the process.

If a problem is found, an event is logged and an SNMP trap is generated indicating one of the following conditions has been identified:

1 Unknown AP with an invalid SSID – *Critical Alarm*

A new device has been identified

2 Unknown AP with a valid SSID – *Critical Alarm*

Someone may be trying to attract users by broadcasting a known SSID.

3 Known AP with an invalid SSID – *Critical Alarm*

A Rogue may be spoofing a know MAC address.

4 Known Wireless AP with an invalid SSID– *Major Alarm*

A Rogue may be spoofing a Wireless AP using a known MAC address.

5 Device that is in ad-hoc mode (IBSS) – *Major Alarm*

A client configured in ad-hoc mode has been identified

6 Inactive Wireless AP with known SSID – *Major Alarm*

A "known" Wireless AP has been detected that the Summit WM Controller has identified as not in service (stolen?)

7 Inactive Wireless AP with unknown SSID – *Major Alarm*

A "known" Wireless AP with an unknown SSID has been detected that the Summit WM Controller has identified as not in service (stolen?)

8 Known AP with Valid SSID Suppress Conflict – *Critical Alarm*

A "known" Altitude AP with a valid SSID has been detected, however the configured AP is not broadcasting the SSID value (suppressed). Instead, the rogue device is broadcasting the SSID.

With each event, the following information will be reported:

- Scanning Wireless AP Name & Scan Group
- Detection Date and Time
- Rogue SSID and Channel
- Signal Strength (RSSI)
- Security/Encoding type (for example. WEP, 802.1X, none, and so on)

This information is available through SNMP, or by viewing a report displayed in the Summit WM GUI. In addition, a summary screen is provided as a pop-up window that provides a summary of all potential problem areas on a single screen.

NOTES: A Few Points Related to Summit WM series Spy and Rogue Systems in General.

- Due to the fact that accuracy is suspect, an administrator will more than likely still have to hunt the rogue in person with a handheld/laptop to find the exact location. So, even using just the Summit WM Controller's Summit WM series Spy information (mentally weigh and plot RSSI values from the scan group APs) an administrator can locate a rogue just as easily as with graphic tools.
- Some other systems address rogue APs with a function known as "containment". The effectiveness of containment may vary due to some inherent limitations of this method. For example, most containment is done via RF bombardment or via a ping DOS to the rogue device. Unless WLAN gear uses very directional or phased array antenna systems, the bombardment is not discriminating and will impact every device (MUs included) in close proximity. Also, if a rogue containment AP is launching an attack (for containment) the service expectation of the client may be impacted. And finally, because WiFi works in an UNLICENSED spectrum, a rogue containment system may inadvertently attack a co-existing, legitimate system operating in an open spectrum.

4 Creating the Windows Security Infrastructure

To ensure information and best practice configuration integrity, all information contained in this section was extracted from this source:

- "**Deploying Secure 802.11 Wireless Networks with Microsoft Windows**", by Joseph Davies

http://www.microsoft.com/technet/prodtechnol/winxppro/deploy/ed80211.mspx

Wireless client computers running Windows:

Windows XP and Windows Server 2003 have built-in support for IEEE 802.11 wireless access and IEEE 802.1X authentication using the Extensible Authentication Protocol (EAP). Windows 2000 supports IEEE 802.1X authentication when either Windows 2000 Service Pack 4 (SP4) or Windows 2000 Service Pack 3 (SP3) and Microsoft 802.1X Authentication Client is installed (Windows 2000 SP4 is recommended).

At least two Internet Authentication Service (IAS) servers:

At least two IAS servers (one primary and one secondary) are used to provide fault tolerance for Remote Authentication Dial-In User Service (RADIUS)-based authentication. If only one RADIUS server is configured and it becomes unavailable, wireless access clients cannot connect. By using two IAS servers and configuring all wireless access points (APs) (the RADIUS clients) for both the primary and secondary IAS servers, the RADIUS clients can detect when the primary RADIUS server is unavailable and automatically fail over to the secondary IAS server.

You can use either Windows Server 2003 or Windows 2000 Server IAS. IAS servers running Windows 2000 must have either SP4 or SP3 with Microsoft 802.1X Authentication Client installed (Windows 2000 SP4 is recommended). IAS is not included with Windows Server 2003, Web Edition

Active Directory® directory service domains:

Active Directory domains contain the user accounts, computer accounts, and dial-in properties that each IAS server requires to authenticate credentials and evaluate authentication. While not a requirement, to both optimize IAS authentication and authentication response times and minimize network traffic, IAS should be installed on Active Directory domain controllers. You can use either Windows Server 2003 or Windows 2000 Server domain controllers. Windows 2000 domain controllers must have SP3 or SP4 installed.

Computer certificates installed on the IAS servers:

Regardless of which wireless authentication method you use, you must install computer certificates on the IAS servers.

For EAP-TLS authentication, a certificate infrastructure:

When the Extensible Authentication Protocol-Transport Level Security (EAP-TLS) authentication protocol is used with computer and user certificates on wireless clients, a certificate infrastructure, also known as a public key infrastructure (PKI), is needed to issue certificates

For Protected EAP (PEAP) with Microsoft Challenge Handshake Authentication Protocol version 2 (MS-CHAP v2) authentication, root certification authority (CA) certificates on each wireless client. PEAP-MS-CHAP v2 is a password-based secure authentication method for wireless connections. Depending on the

issuer of the IAS server computer certificates, you might also have to install root CA certificates on each wireless client.

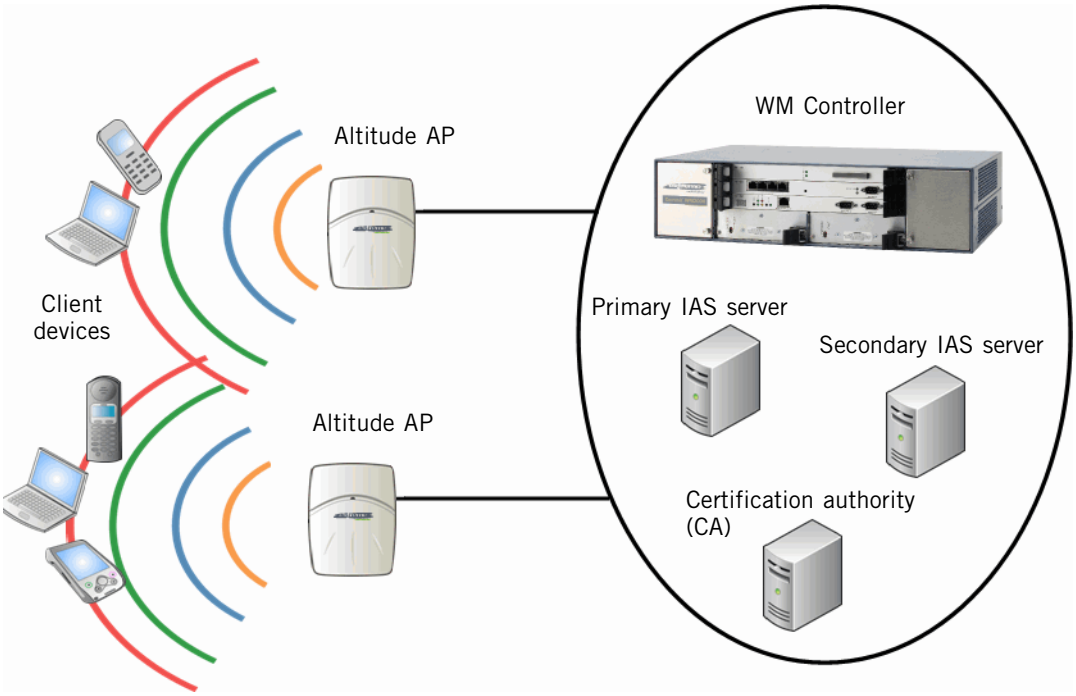
Wireless remote access policy:

A remote access policy is configured for wireless connections so that employees can access the organization intranet.

Multiple wireless APs:

Multiple third-party wireless APs provide wireless access in different buildings of an enterprise. The wireless APs must support IEEE 802.1X, RADIUS, and Wi-Fi Protected Access (WPA™) or WPA2™. Wired Equivalent Privacy (WEP) is recommended only for temporary use when transitioning to WPA or WPA2.

Figure 5: Typical enterprise wireless configuration



Intranet Wireless Deployment Steps

For this configuration, complete the following steps:

- Step 1: Configuring the Certificate Infrastructure
- Step 2: Configuring Active Directory for Accounts and Groups
- Step 3: Configuring the Primary IAS Server
- Step 4: Configuring the secondary IAS server (if applicable)
- Step 5: Deploying and Configuring Wireless APs.
- Step 6: Configuring Wireless Network (IEEE 802.11) Policies Group Policy Settings
- Step 7: Installing Computer Certificates on Wireless Client Computers for EAP-TLS

- Step 8: Installing User Certificates on Wireless Client Computers for EAP-TLS
- Step 9: Configuring Wireless Clients for EAP-TLS
- Step 10: Configuring Wireless Client Computers for PEAP-MS-CHAP v2

Step 1: Configuring the Certificate Infrastructure

Table 12 summarizes the certificates needed for the different types of authentication.

Table 12: Authentication types and certificates

Authentication Type	Certificates on Wireless Client	Certificates on IAS Server
EAP-TLS	Computer certificates User certificates Root CA certificates for issuers of IAS server computer certificates	Computer certificates Root CA certificates for issuers of wireless client computer and user certificates
PEAP-MS-CHAP v2	Root CA certificates for issuers of IAS server computer certificates	Computer certificates

- Regardless of which authentication method you use for wireless connections, EAP-TLS or PEAP-MS-CHAP v2, you must install computer certificates on the IAS servers.
- For PEAP-MS-CHAP v2, you do not have to deploy a certificate infrastructure to issue computer and user certificates for each wireless client computer. Instead, you can obtain individual certificates for each IAS server in your enterprise from a commercial certification authority and install them on the IAS servers.
  - For more information, see "Step 3: Configuring the Primary IAS Server" and "Step 4: Configuring the Secondary IAS Server" in this article. Windows wireless clients include a number of root CA certificates for well known and trusted commercial CAs. If you obtain computer certificates from a commercial CA for which there is already an installed root CA certificate, there are no additional certificates to install on the Windows wireless clients.
  - If you obtain computer certificates from a commercial CA for which there is not already an installed root CA certificate, you must install the root CA certificates for the issuers of the computer certificates installed on the IAS servers on each Windows wireless client. For more information, see "Step 10: Configuring Wireless Client Computers for PEAP-MS-CHAP v2" in this article.
- For computer authentication with EAP-TLS, you must install a computer certificate, also known as a machine certificate, on the wireless client computer. A computer certificate installed on the wireless client computer is used to authenticate the wireless client computer so that the computer can obtain network connectivity to the enterprise intranet and computer configuration Group Policy updates prior to user login. For user authentication with EAP-TLS after a network connection is made and the user logs in, you must use a user certificate on the wireless client computer.
- The computer certificate is installed on the IAS server computer so that during EAP-TLS authentication, the IAS server has a certificate to send to the wireless client computer for mutual authentication, regardless of whether the wireless client computer authenticates with a computer certificate or a user certificate. The computer and user certificates submitted by the wireless client and IAS server during EAP-TLS authentication must conform to the requirements specified in "Using a Third-Party CA" in this article.
- In Windows Server 2003, Windows XP, and Windows 2000, you can view the certificate chain from the **Certification Path** tab in the properties of a certificate in the Certificates snap-in. You can view

the installed root CA certificates in the Trusted Root Certification Authorities\Certificates folder and you can view the intermediate CA certificates in the Intermediate Certification Authorities\Certificates folder.

- In a typical enterprise deployment, the certificate infrastructure is configured using single root CA in a three-level hierarchy consisting of root CA/intermediate CAs/issuing CAs. Issuing CAs are configured to issue computer certificates or user certificates. When the computer or user certificate is installed on the wireless client, the issuing CA certificate, intermediate CA certificates, and the root CA certificate is also installed. When the computer certificate is installed on the IAS server computer, the issuing CA certificate, intermediate CA certificates, and the root CA certificate is also installed. The issuing CA for the IAS server certificate can be different than the issuing CA for the wireless client certificates. In this case, both the wireless client and the IAS server computer have all the required certificates to perform certificate validation for EAP-TLS authentication.

Best Practices

- If you are using EAP-TLS authentication, use both user and computer certificates for both user and computer authentication.
- If you are using EAP-TLS authentication, do not also use PEAP-TLS. Allowing both protected and unprotected authentication traffic for the same type of network connection renders the protected authentication traffic susceptible to spoofing attacks.
- If you already have a certificate infrastructure for EAP-TLS authentication and are using RADIUS for dial-up or virtual private network (VPN) remote access connections, you can skip some of the certificate infrastructure steps. You can use the same certificate infrastructure for wireless connections. However, you must ensure that computer certificates are installed for computer authentication.
- For computers running Windows XP with no service packs installed, you must have user certificates stored on the computer for user authentication (rather than using smart cards).
- For computers running Windows Server 2003, Windows XP with Service Pack (SP1), Windows XP with Service Pack 2 (SP2), or Windows 2000, you can use either user certificates stored on the computer or a smart card for user authentication.

Step 1a: Installing a Certificate Infrastructure

When installing a certificate infrastructure, use the following best practices:

- Plan your public key infrastructure (PKI) before deploying CAs.
- The root CA should be offline and its signing key should be secured by a Hardware Security Module (HSM) and kept in a vault to minimize potential for key compromise.
- Enterprise organizations should not issue certificates to users or computers directly from the root CA, but rather should deploy the following:
  - An offline root CA
  - Offline intermediate CAs
  - Online issuing CAs (using Windows Server 2003 or Windows 2000 Certificate Services as an enterprise CA)
  - This CA hierarchy provides flexibility and insulates the root CA from attempts to compromise its private key by malicious users. The offline root and intermediate CAs do not have to be Windows Server 2003 or Windows 2000 CAs. Issuing CAs can be subordinates of a third party intermediate CA.

- Backing up the CA database, the CA certificate, and the CA keys is essential to protect against the loss of critical data. The CA should be backed up on a regular basis (daily, weekly, monthly) based on the number of certificates issued over the same interval. The more certificates issued, the more frequently you should back up the CA.
- You should review the concepts of security permissions and access control in Windows, since enterprise CAs issue certificates based on the security permissions of the certificate requester.

Additionally, if you want to take advantage of autoenrollment for computer certificates, use Windows 2000 or Windows Server 2003 Certificate Services and create an enterprise CA at the issuer CA level. If you want to take advantage of autoenrollment for user certificates, use Windows Server 2003, Enterprise Edition, or Windows Server 2003, Datacenter Edition, Certificate Services and create an enterprise CA at the issuer CA level.

By default, the IAS server checks for certificate revocation for all the certificates in the certificate chain sent by the wireless client during the EAP-TLS authentication process. If certificate revocation fails for any of the certificates in the chain, the connection attempt is not authenticated and is denied. The certificate revocation check for a certificate can fail because of the following:

- The certificate has been revoked, The issuer of the certificate has explicitly revoked the certificate.
- The certificate revocation list (CRL) for the certificate is not reachable or available.
  - CAs maintain CRLs and publish them to specific CRL distribution points. The CRL distribution points are included in the CRL Distribution Points property of the certificate. If the CRL distribution points cannot be contacted to check for certificate revocation, then the certificate revocation check fails.
  - Additionally, if there are no CRL distribution points in the certificate, the IAS server cannot verify that the certificate has not been revoked and the certificate revocation check fails.
- The publisher of the CRL did not issue the certificate.
- Included in the CRL is the publishing CA. If the publishing CA of the CRL does not match the issuing CA for the certificate for which certificate revocation is being checked, then the certificate revocation check fails.
- The CRL is not current
  - Each published CRL has a range of valid dates. If the CRL **Next update** date has passed, the CRL is considered invalid and the certificate revocation check fails. New CRLs should be published before the expiration date of the last published CRL

Because certificate revocation checking can prevent wireless access due to the unavailability or expiration of CRLs for each certificate in the certificate chain, design your PKI for high availability of CRLs. For instance, configure multiple CRL distribution points for each CA in the certificate hierarchy and configure publication schedules that ensure that the most current CRL is always available.

Certificate revocation checking is only as accurate as the last published CRL. For example, if a certificate is revoked, by default the new CRL containing the newly revoked certificate is not automatically published. CRLs are typically published based on a configurable schedule. This means that the revoked certificate can still be used to authenticate because the published CRL is not current; it does not contain the revoked certificate and can therefore still be used to create wireless connections. To prevent this from occurring, the network administrator must manually publish the new CRL with the newly revoked certificate.

By default the IAS server uses the CRL distribution points in the certificates. However, it is also possible to store a local copy of the CRL on the IAS server. In this case, the local CRL is used during certificate revocation checking. If a new CRL is manually published to the Active Directory, the local CRL on the IAS server is not updated. The local CRL is updated when it expires. This can create a situation wherein

a certificate is revoked, the CRL is manually published, but the IAS server still allows the connection because the local CRL has not yet been updated.

Step 1b: Installing Computer Certificates

If you are using a Windows Server 2003 or Windows 2000 Certificate Services enterprise CA as an issuing CA, you can install a computer certificate on the IAS server by configuring Group Policy for the autoenrollment of computer certificates for computers in an Active Directory system container.

To configure computer certificate enrollment for an enterprise CA:

1. Open the Active Directory Users and Computers snap-in.
2. In the console tree, double-click **Active Directory Users and Computers**, right-click the domain name to which your CA belongs, and then click **Properties**
3. On the **Group Policy** tab, click the appropriate Group Policy object (the default object is **Default Domain Policy**), and then click **Edit**.
4. In the console tree, open **Computer Configuration**, then **Windows Settings**, then **Security Settings**, then **Public Key Policies**, then **Automatic Certificate Request Settings**.
5. Right-click **Automatic Certificate Request Settings**, point to **New**, and then click **Automatic Certificate Request**.
6. The Automatic Certificate Request wizard appears. Click **Next**.
7. In **Certificate templates**, click **Computer**, and then click **Next**. Your enterprise CA appears on the list
8. Click the enterprise CA, click **Next**, and then click **Finish**.
9. To immediately obtain a computer certificate for the CA that is running Windows 2000 Server, type the following at a command prompt: **secedit /refreshpolicy machine_policy**
10. To immediately obtain a computer certificate for the CA that is running Windows Server 2003, type the following at a command prompt: **gpupdate /target:computer**

After the domain is configured for autoenrollment, each computer that is a member of the domain requests a computer certificate when computer Group Policy is refreshed. By default, the Winlogon service polls for changes in Group Policy every 90 minutes. To force a refresh of computer Group Policy, restart the computer or type **secedit /refreshpolicy machine_policy** (for a computer running Windows 2000) or **gpupdate /target:computer** (for a computer running Windows XP or Windows Server 2003) at a command prompt. Perform this procedure for each domain system container as appropriate.

Best Practices

If you use a Windows Server 2003 or Windows 2000 enterprise CA as an issuing CA, configure autoenrollment of computer certificates to install computer certificates on all computers. Ensure that all appropriate domain system containers are configured for autoenrollment of computer certificates either through the inheriting of group policy settings of a parent system container or explicit configuration

Step 1c: Installing User Certificates

If you are using a Windows Server 2003, Enterprise Edition, or Windows Server 2003, Datacenter Edition, enterprise CA as an issuing CA, you can install user certificates through autoenrollment. Configuring user certificate autoenrollment for wireless user certificates requires you to duplicate

existing certificate templates, a feature that is only supported for Windows Server 2003, Enterprise Edition, or Windows Server 2003, Datacenter Edition, enterprise CAs.

Only Windows XP and Windows Server 2003 wireless clients support user certificate autoenrollment.

To configure user certificate enrollment for a Windows Server 2003, Enterprise Edition, or Windows Server 2003, Datacenter Edition, enterprise CA:

1 Click **Start**, click **Run**, type **mmc**, and then click **OK**.

2 On the **File** menu, click **Add/Remove Snap-in**, and then click **Add**.

3 Under **Snap-in,** double-click **Certificate Templates**, click **Close**, and then click **OK**.

4 In the console tree, click **Certificate Templates**. All of the certificate templates will be displayed in the details pane.

5 In the details pane, click the **User** template.

6 On the **Action** menu, click **Duplicate Template**.

7 In the **Display Name** field, type **WirelessUser** (example name).

8 Make sure that the **Publish Certificate in Active Directory** check box is selected.

9 Click the **Security** tab.

10 In the **Group or user names** field, click **Domain Users**.

11 In the **Permissions for Domain Users** list, select the **Enroll** and **Autoenroll** permission check boxes and then click **OK**.

12 Open the Certification Authority snap-in.

13 In the console tree, open **Certification Authority**, then the CA name, then **Certificate Templates**.

14 On the **Action** menu, point to **New**, and then click **Certificate to Issue**.

15 Click **WirelessUser** (example) and click **OK**

16 Open the Active Directory Users and Computers snap-in.

17 In the console tree, double-click **Active Directory Users and Computers**, right-click the domain system container that contains the wireless user accounts, and then click **Properties**.

18 On the **Group Policy** tab, click the appropriate Group Policy object (the default object is **Default Domain Policy**), and then click **Edit**.

19 In the console tree, open **User Configuration**, then **Windows Settings**, then **Security Settings**, then **Public Key Policies**.

20 In the details pane, double-click **Autoenrollment Settings**

21 Click **Enroll certificates automatically**.

22 Select the **Renew expired certificates, update pending certificates, and remove revoked certificates** check box.

23 Select the **Update certificates that use certificate templates** check box and click **OK**

Perform steps 17-23 for each domain system container as appropriate.

Best Practices

If you use a Windows Server 2003, Enterprise Edition, or Windows Server 2003, Datacenter Edition, enterprise CA as an issuing CA, configure autoenrollment of user certificates to install user certificates on all computers. Ensure that all appropriate domain system containers are configured for autoenrollment of user certificates either through the inheriting of group policy settings of a parent system container or explicit configuration.

Step 2: Configuring Active Directory for Accounts and Groups

To configure Active Directory user and computer accounts and groups for wireless access, do the following:

1. If you are using Windows 2000 domain controllers, install Windows 2000 SP3 or SP4 on all domain controllers.
2. Ensure that all users that are making wireless connections have a corresponding user account.
3. Ensure that all computers that are making wireless connections have a corresponding computer account.
4. Set the remote access permission on user and computer accounts to the appropriate setting (either **Allow access** or **Control access through Remote Access Policy**). The remote access permission setting is on the **Dial-in** tab on the properties of a user or computer account in the Active Directory Users and Computers snap-in.
5. Organize your wireless access user and computer accounts into the appropriate groups. For a native-mode domain, you can use universal and nested global groups. For example, create a universal group named Wireless Users that contains global groups of wireless user and computer accounts for intranet access.

Best Practice

Use a native-mode domain and universal groups and global groups to organize your wireless accounts into a single group.

Step 3: Configuring the Primary IAS Server

Configuring the primary IAS server on a computer involves the following:

- Configuring IAS to be able to access account information, logging, UDP ports, and for the RADIUS clients corresponding to the wireless APs.
- Configuring a remote access policy for wireless access.

Step 3a: Configuring IAS

To configure the primary IAS server on a computer, do the following:

1. If you are using computer certificate autoenrollment and Windows 2000 IAS, force a refresh of computer Group Policy by typing **secedit /refreshpolicy machine_policy** from a command prompt. If you are using computer certificate autoenrollment and Windows Server 2003 IAS, force a refresh of computer Group Policy by typing **gpupdate /target:computer** from a command prompt.
2. If you are using PEAP-MS-CHAP v2 authentication and have obtained a computer certificate from a commercial CA, use the Certificates snap-in to import it into the Certificates (Local Computer)\Personal\Certificates folder. To perform this procedure, you must be a member of the Administrators group on the local computer, or you must have been delegated the appropriate authority. It is also possible to import a certificate by double-clicking a certificate file that is stored in a folder or sent in an email message. Although this works for certificates created with Windows

CAs, this method does not work for third-party CAs. The recommended method of importing certificates is to use the Certificates snap-in. For information about how to install a VeriSign, Inc. certificate for PEAP-MS-CHAP v2 authentication, see Obtaining and Installing a VeriSign WLAN Server Certificate for PEAP-MS-CHAP v2 Wireless Authentication.

3 Install IAS as an optional networking component.

4 If you are using Windows 2000 IAS, install Windows 2000 SP4.

5 The primary IAS server computer must be able to access account properties in the appropriate domains. If IAS is being installed on a domain controller, no additional configuration is required in order for IAS to access account properties in the domain of the domain controller. If IAS is not installed on a domain controller, you must configure the primary IAS server computer to read the properties of user accounts in the domain. For more information, see the "Enable the IAS server to read user accounts in Active Directory" procedure in this section. If the IAS server authenticates and authorizes wireless connection attempts for user accounts in other domains, verify that the other domains have a two-way trust with the domain in which the IAS server computer is a member. Next, configure the IAS server computer to read the properties of user accounts in other domains. For more information, see the "Enable the IAS server to read user objects in Active Directory" procedure in this section. If there are accounts in other domains, and those domains do not have a two-way trust with the domain in which the IAS server computer is a member, you must configure a RADIUS proxy between the two untrusted domains. If there are accounts in other Active Directory forests, you must configure a RADIUS proxy between the forests. For more information, see "Cross-Forest Authentication" in this article.

6 If you want to store authentication and accounting information for connection analysis and security investigation purposes, enable logging for accounting and authentication events. Windows 2000 IAS can log information to a local file. Windows Server 2003 IAS can log information to a local file and to a Structured Query Language (SQL) server database. For more information, see the topic titled "Configure log file properties" in Windows 2000 Help and the topic titled "Configure logging for user authentication and accounting" in Windows Server 2003 Help and Support.

7 If needed, configure additional UDP ports for authentication and accounting messages that are sent by RADIUS clients (the wireless APs). For more information, see the "Configure IAS port information" procedure in this section. By default, IAS uses UDP ports 1812 and 1645 for authentication messages and UDP ports 1813 and 1646 for accounting messages.

8 Add the wireless APs as RADIUS clients of the IAS server. For more information, see the "Add RADIUS clients" procedure in this section. Verify that you are configuring the correct name or IP address and shared secret for each Altitude AP. Use a different shared secret for each Altitude AP. Each shared secret should be a random sequence of upper and lowercase letters, numbers, and punctuation that is at least 22 characters long. To ensure randomness, use a random character generation program to create shared secrets to configure on the IAS server and the Altitude AP. To ensure the maximum security for RADIUS messages, it is recommended that you use Internet Protocol security (IPsec) Encapsulating Security Payload (ESP) with certificate authentication to provide data confidentiality, data integrity, and data origin authentication for RADIUS traffic sent between the IAS servers and the wireless APs. Windows 2000 and Windows Server 2003 support IPsec. IPsec must also be supported by the wireless APs.

Enable the IAS server to read user accounts in Active Directory

To register the IAS server in the default domain using Internet Authentication Service:

1 Log on to the IAS server with an account that has domain administrator permissions.

2 Open the Internet Authentication Service snap-in.

3 Right-click Internet Authentication Service, and then click **Register Server in Active Directory**. When the **Register Internet Authentication Service in Active Directory** dialog box appears, click **OK**

Register the IAS server in the default domain using the netsh tool

1 Log on to the IAS server with an account that has domain administrator permissions.
2 Open a command prompt.
3 At the command prompt, type: netsh ras add registeredserver

To register the IAS server in the default domain using Active Directory Users and Computers:

1 Log on to the IAS server with an account that has domain administrator permissions.
2 Open the Active Directory Users and Computers snap-in.
3 In the console tree, click the **Users** folder in the appropriate domain.
4 In the details pane, right-click **RAS and IAS Servers**, and then click **Properties**.
5 In the **RAS and IAS Servers Properties** dialog box, on the **Members** tab, add the IAS server

Register the IAS server in another domain using Active Directory Users and Computers

1 Log on to the IAS server with an account that has domain administrator permissions.
2 Open the Active Directory Users and Computers snap-in.
3 In the console tree, click the **Users** folder in the appropriate domain.
4 In the details pane, right-click **RAS and IAS Servers**, and then click **Properties**.
5 In the **RAS and IAS Servers Properties** dialog box, on the **Members** tab, add each of the appropriate IAS servers.

Register the IAS server in another domain using the netsh tool

1 Log on to the IAS server with an account that has domain administrator permissions.
2 Open a command prompt.
3 At the command prompt, type: **netsh ras add registeredserver** Domain IASServer in which Domain is the DNS domain name of the domain and IASServer is the name of the IAS server computer.

Configure IAS port information

1 Open the Internet Authentication Service snap-in.
2 Right-click **Internet Authentication Service**, and then click **Properties**
3 For Windows 2000 IAS, click the **RADIUS** tab. For Windows Server 2003, click the **Ports** tab. Examine the settings for ports. If your RADIUS authentication and RADIUS accounting UDP ports differ from the default values provided (1812 and1645 for authentication and 1813 and1646 for accounting), in **Authentication** and **Accounting**, type your port settings. To use multiple ports for authentication or accounting requests, separate the ports with commas.

Add RADIUS clients

1 Open the Internet Authentication Service snap-in.

2 For Windows 2000 IAS, in the console tree, right-click **Clients**, and then click **New Client**. For Windows Server 2003 IAS, in the console tree, right-click **RADIUS Clients**, and then click **New RADIUS Client**.

3 In **Friendly name**, type a descriptive name.

4 In **Protocol**, click **RADIUS**, and then click **Next**.

5 In **Client address (IP or DNS)**, type the DNS name or IP address for the client. If you are using a DNS name, click **Verify**. In the **Resolve DNS Name** dialog box, click **Resolve**, and then select the IP address you want to associate with that name from **Search Results**.

6 If you are planning to use Altitude AP-specific remote access policies for configuration purposes (for example, a remote access policy that contains vendor-specific attributes), click **Client Vendor**, and select the manufacturer's name. If you do not know the manufacturer or it is not in the list, click **RADIUS Standard**.

7 In **Shared secret**, type the shared secret for the client, and then type it again in **Confirm shared secret**.

8 Click **Finish**.

Best Practices

If possible, use IPsec ESP to provide data confidentiality for RADIUS traffic between the Altitude AP and the IAS servers. Use at least 3DES encryption and, if possible, certificates for Internet Key Exchange (IKE) main mode authentication.

Use shared secrets that consist of a random sequence of upper and lower case letters, numbers, and punctuation at least 22 characters long and use a different shared secret for each Altitude AP. If possible, use a random string-generating computer program to create the shared secret

Step 3b: Configuring a Wireless Remote Access Policy

To configure a wireless remote access policy for the primary IAS server, do the following:

1 For Windows 2000 IAS, create a new remote access policy for wireless intranet access with the following settings:

   a Policy name: Wireless access to intranet (example)

   b Conditions: NAS-Port-Type=Wireless-Other and Wireless-IEEE 802.11, Windows-Groups=WirelessUsers

   c Permissions: Select Grant remote access permission.

   d Profile, **Authentication** tab: If you are using EAP-TLS authentication, select **Extensible Authentication Protocol** and the **Smart Card or other Certificate** EAP type. Clear all other check boxes. If you have multiple computer certificates installed on the IAS server, click **Configure**, and then select the appropriate computer certificate. If the intended computer certificate is not displayed, then it does not support SChannel.

   If you are using PEAP-MS-CHAP v2 authentication, select **Extensible Authentication Protocol** and the **Protected EAP (PEAP)** EAP type, and then click **Configure**. In the **Protected EAP Properties** dialog box, select the appropriate computer certificate and ensure that **Secured password (EAP-MSCHAP v2)** is selected as the EAP type.

Profile, **Encryption** tab: Clear all other check boxes except the **Strongest** check box. This forces all wireless connections to use 128-bit encryption. The settings on the **Encryption** tab correspond to the MS-MPPE-Encryption-Policy and MS-MPPE-Encryption-Types RADIUS attributes and might be supported by the Altitude AP. If these attributes are not supported, clear all the check boxes except **No encryption**.For more information, see the "Add a remote access policy" procedure in this section

2 For Windows Server 2003 IAS, use the New Remote Access Policy Wizard to create a common remote access policy with the following settings:

   a Policy name: Wireless access to intranet (example)

   b Access Method: Wireless

   c User or Group Access: Group with the Wireless Users group selected (example group name)

   d Authentication Methods: **Smart Card or other Certificate** type (for EAP-TLS) or **Protected EAP (PEAP)** type (for EAP-MS-CHAP v2)

3 If the wireless APs require vendor specific attributes (VSAs), you must add the VSAs to the remote access policy. For more information, see the "Configure vendor-specific attributes for a remote access policy" procedure in this section.

4 For Windows 2000 IAS, delete the default remote access policy named **Allow access if dial-in permission is enabled**. To delete a remote access policy, right-click the policy name in the Internet Authentication Service snap-in and click **Delete**

Best Practice

If you are managing the remote access permission of user and computer accounts on a per-account basis, use remote access policies that specify a connection type. If you are managing the remote access permission through the remote access policy, use remote access policies that specify a connection type and group. The recommended method is to manage remote access permission through the remote access policy.

Add a remote access policy

1 Open the Internet Authentication Service snap-in.

2 In the console tree, right-click **Remote Access Policies**, and then click **New Remote Access Policy**.

Configure vendor-specific attributes for a remote access policy

1 Open the Internet Authentication Service snap-in.

2 In the console tree, click **Remote Access Policies**.

3 In the details pane, double-click the policy for which you want to configure a vendor-specific attribute (VSA).

4 Click **Edit Profile**, click the **Advanced** tab, and then click **Add**.

5 Look at the list to see whether your vendor-specific attribute is already in the list of available RADIUS attributes. If it is, double-click it, and then configure it as specified in your Altitude AP documentation.

6 If the vendor-specific attribute is not in the list of available RADIUS attributes, click the **Vendor-Specific** attribute, and then click **Add**.

7 In the **Multivalued Attribute Information** dialog box, click **Add**

8 Specify the vendor for your Altitude AP. To specify the vendor by selecting the name from the list, click **Select from list**, and then select the vendor of the Altitude AP for which you are configuring the VSA. If the vendor is not listed, specify the vendor by typing the vendor code.

9 To specify the vendor by typing the vendor code, click **Enter Vendor Code** and then type the vendor code in the space provided. See RFC 1007 for a list of SMI Network Management Private Enterprise Codes.

10 Specify whether the attribute conforms to the VSA format specified in RFC 2865. If you are not sure, see your Altitude AP documentation.

11 If your attribute conforms, click **Yes**. **It conforms**, and then click **Configure Attribute**. In **Vendor-assigned attribute number**, type the number assigned to the attribute (this should be an integer from 0 to 255). In **Attribute format**, specify the format for the attribute, and then in **Attribute value**, type the value you are assigning to the attribute.

12 If the attribute does not conform, click **No. It does not conform**, and then click **Configure Attribute**. In **Hexadecimal attribute value**, type the value for the attribute.

Best Practice

Investigate whether the wireless APs need VSAs and configure them during the configuration of the remote access policy. If you configure the VSAs after you configure the wireless APs, you have to re-synchronize the configuration of the primary IAS server to the secondary IAS server.

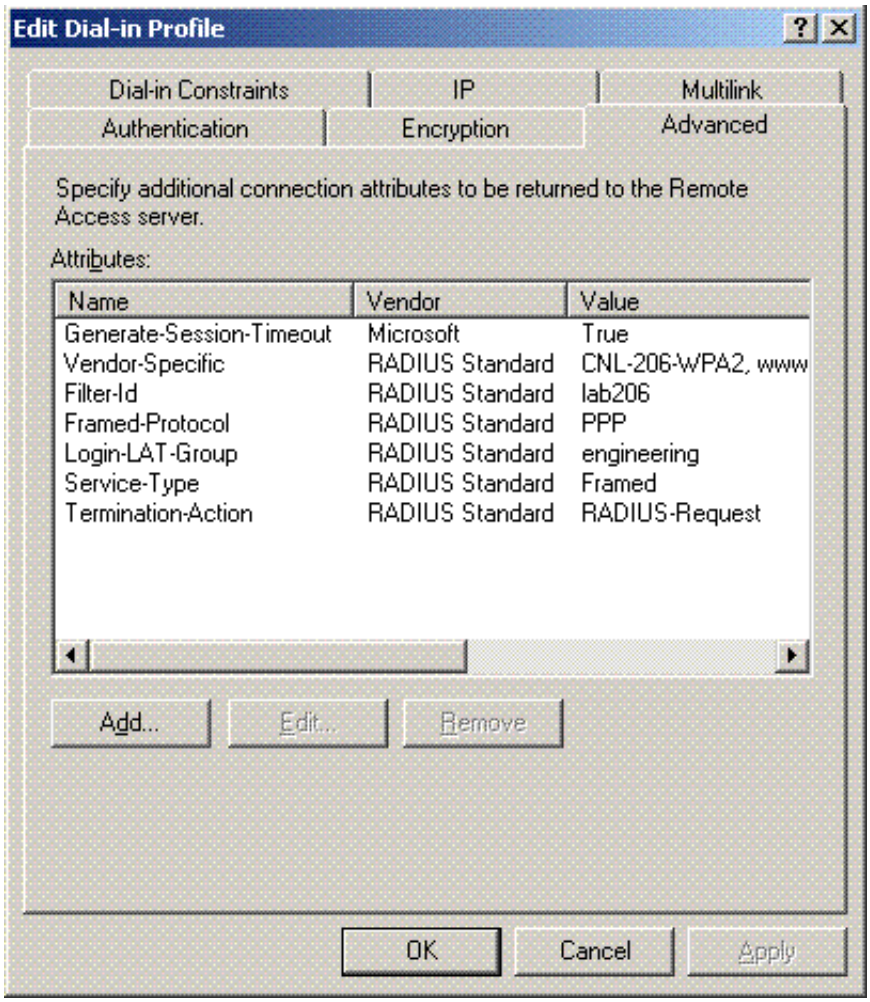
How to configure VSAs in the IAS server (Example)

1 Open Internet Authentication Service/Remote Access Policy.

2 Select the policy or create a new one. To create a new one:

- Right-click **Remote Access Policies**, and then select **New Remote Access Policy**. The **New Remote Access Policy** wizard is displayed.
- Follow the wizard steps to create a new policy.

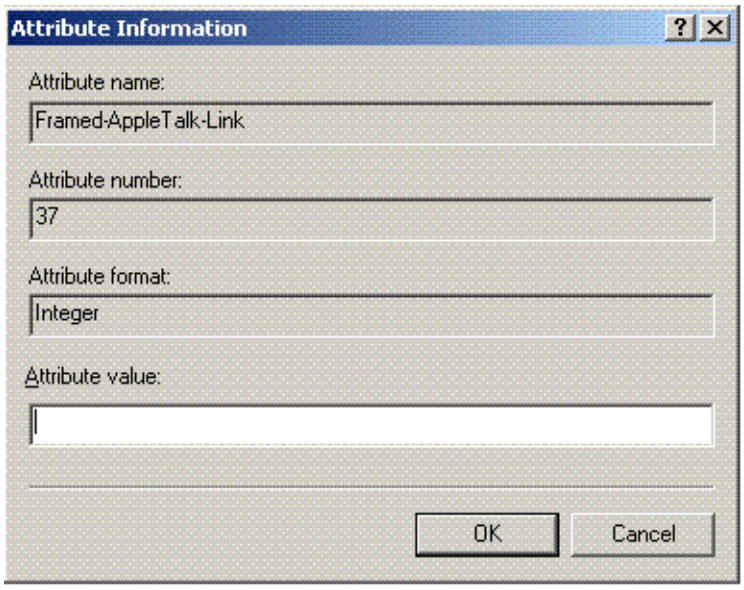
3 Click **Edit Profile**. The **Edit Dial-In Profile** dialog is displayed.



4 Click the **Advanced** tab.

5 Click **Add**. The **Add Attribute** dialog is displayed.

6 From the list, select the applicable Vendor Specific Attribute, and then click **Add**. The **Attribute Information** dialog is displayed.



7 In the **Attribute value** box, type `4329` as the vendor number, and then click **Ok**.

8 Configure the applicable attributes as per the dictionary file at: /etc/extreme/raddb/dictionary.extreme.

Dictionary file

File at /etc/extreme/raddb/dictionary.extreme the VSAs are:

```
# dictionary.extreme - Extreme Networks Summit WM LAN Controller VSA dictionary

VENDOR          Extreme Networks   4329
BEGIN-VENDOR    Extreme Networks
Standard Attribute
ATTRIBUTE       Extreme-URL-Redirection 1       string
ATTRIBUTE       Extreme-AP-Name         2       string
ATTRIBUTE       Extreme-AP-Serial       3       string
ATTRIBUTE       Extreme-WM-AD-Name        4       string
ATTRIBUTE       Extreme-SSID            5       string
ATTRIBUTE       Extreme-BSS-MAC         6       string
END-VENDOR      Extreme
```

Copy the file dictionary.extreme into the same directory where all the other vendor dictionaries are. Default is **/usr/local/share/freeradius/.**

Then edit the file **/usr/local/share/freeradius/dictionary** and add an include statement for **dictionary.extreme**. See extract below:

```
. . .
$INCLUDE dictionary.cabletron
$INCLUDE dictionary.cisco
$INCLUDE dictionary.extreme
#
```

Step 4: Configuring the secondary IAS server (if applicable)

To configure the secondary IAS server on another computer, do the following:

1 If you are using computer certificate autoenrollment and Windows 2000 IAS, force a refresh of computer Group Policy by typing **secedit /refreshpolicy machine_policy** from a command prompt. If you are using computer certificate autoenrollment and Windows Server 2003 IAS, force a refresh of computer Group Policy by typing **gpupdate /target:computer** from a command prompt.

2 If you are using PEAP-MS-CHAP v2 authentication and have obtained a computer certificate from a commercial CA, use the Certificates snap-in to import it into the Certificates (Local Computer)\ Personal\Certificates folder.

3 Install IAS as an optional networking component.

4 If you are using Windows 2000 IAS, install Windows 2000 SP4.

5 The secondary IAS server computer must be able to access account properties in the appropriate domains. If IAS is being installed on a domain controller, no additional configuration is required in order for IAS to access account properties in the domain of the domain controller.
If IAS is not installed on a domain controller, you must configure the secondary IAS server computer to read the properties of user accounts in the domain. For more information, see the "Enable the IAS server to read user accounts in Active Directory" procedure previously described.
If the secondary IAS server authenticates and authorizes connection attempts for user accounts in other domains, verify that the other domains have a two-way trust with the domain in which the secondary IAS server computer is a member. Next, configure the secondary IAS server computer to read the properties of user accounts in other domains. For more information, see the "Enable the IAS server to read user objects in Active Directory" procedure previously described.
accounts in other domains, and those domains do not have a two-way trust with the domain in which the secondary IAS server computer is a member, you must configure a RADIUS proxy between the two untrusted domains. If there are accounts in other Active Directory forests, you must configure a RADIUS proxy between the forests. For more information, see "Cross-Forest Authentication" in this article.

6 To copy the configuration of the primary IAS server to the secondary IAS server, type **netsh aaaa show config >** *path\file.txt* at a command prompt on the primary IAS server. This stores the configuration settings, including registry settings, in a text file. The path can be relative, absolute, or a network path.

7 Copy the file created in step 7 to the secondary IAS server. At a command prompt on the secondary IAS server, type **netsh exec** *path\file.txt*. This command imports all the settings configured on the primary IAS server to the secondary IAS server.

NOTE

You cannot copy the IAS settings from an IAS server running Windows Server 2003 to an IAS server running Windows 2000 Server.

Best Practice

If you change the IAS server configuration in any way, use the Internet Authentication Service snap-in to change the configuration of the primary IAS server and then use steps 7 and 8 above to synchronize those changes on the secondary IAS server

Step 5: Deploying and Configuring Wireless APs

Deploy your wireless APs to provide coverage for all the areas of coverage for your wireless network. Configure your Summit WM Controller and Wireless APs to support WPA, WPA2, or WEP encryption with 802.1X authentication. Additionally, configure RADIUS settings on your Summit WM Controller with the following:

1 The IP address or name of a primary RADIUS server, the shared secret, UDP ports for authentication and accounting, and failure detection settings.

2 The IP address or name of a secondary RADIUS server, the shared secret, UDP ports for authentication and accounting, and failure detection settings.

To balance the load of RADIUS traffic between the two IAS servers, configure half of the wireless APs with the primary IAS server as the primary RADIUS server and the secondary IAS server as the secondary RADIUS server and the other half of the wireless APs with the secondary IAS server as the primary RADIUS server and the primary IAS server as the secondary RADIUS server.

If the wireless APs require vendor specific attributes (VSAs), you must add the VSAs to the remote access policies of the IAS servers. For more information, see the "Configure vendor-specific attributes for a remote access policy" procedure previously described. If you add VSAs to the remote access policy on the primary IAS server, perform steps 7 and 8 of the "Step 4: Configuring the secondary IAS server" section to copy the primary IAS server configuration to the secondary IAS server.

Step 6: Configuring Wireless Network (IEEE 802.11) Policies Group Policy Settings

With the Wireless Network (IEEE 802.11) Policies Group Policy extension provided in Windows Server 2003, you can specify a list of preferred networks and their settings to automatically configure wireless LAN settings for wireless clients running Windows XP with SP1, Windows XP with SP2, Windows Server 2003 with no service packs installed, or Windows Server 2003. For each preferred network, you can specify association settings (such as the SSID and the authentication and encryption method) and 802.1X authentication settings (such as the specific EAP type).

To configure Wireless Network (IEEE 802.11) Policies Group Policy settings, do the following:

1 Open the Active Directory Users and Computers snap-in

2 In the console tree, double-click **Active Directory Users and Computers**, right-click the domain system container that contains your wireless computer accounts, and then click **Properties**.

3 On the **Group Policy** tab, click the appropriate Group Policy object (the default object is **Default Domain Policy**), and then click **Edit**.

4 In the console tree, open **Computer Configuration**, then **Windows Settings**, then **Security Settings**, then **Wireless Network (IEEE 802.11) Policies**.

5 Right-click **Wireless Network (IEEE 802.11) Policies**, and then click **Create Wireless Network Policy**. In the Wireless Network Policy Wizard, type a name and description.

6 In the details pane, double-click your newly created wireless network policy.

7 Change settings on the **General** tab as needed.

8 Click the **Preferred Networks** tab. Click **Add** to add a preferred network.

9 On the **Network Properties** tab, type the wireless network name (SSID) and change wireless network key settings as needed.

10 Click the **IEEE 802.1X** tab. Change 802.1X settings as needed, including specifying and configuring the correct EAP type. Click **OK** twice to save changes.

The next time your Windows XP with SP1, Windows XP with SP2, and Windows Server 2003 wireless clients update computer configuration Group Policy, their wireless network configuration will be automatically configured.

NOTE

The version of the Wireless Network (IEEE 802.11) Policies Group Policy extension in Windows Server 2003 with no service packs installed does not support the configuration of Wi-Fi Protected Access (WPA) authentication and encryption settings for WPA-capable Windows wireless client computers (running Windows XP with SP1 and the WPA Wireless Security Update in Windows XP, Windows XP with SP2, or Windows Server 2003 with SP1). However, support for WPA settings configured through the Wireless Network (IEEE 802.11) Policies Group Policy extension has been added to Windows Server 2003 with either the 811233 update or SP1.

To get the new Wireless Network (IEEE 802.11) Policies Group Policy extension in a Windows 2000 Active Directory domain, the Active Directory schema must be updated to include the new extension. To update the Windows 2000 Active Directory schema, you must install at least one domain controller in your Windows 2000 Active Directory domain that runs either Windows Server 2003 with no service packs installed or Windows Server 2003 with SP1 (for WPA authentication and encryption settings). Once this is complete, you must use the Group Policy snap-in from any domain member computer running either Windows Server 2003 with no service packs installed or Windows Server 2003 with SP1 to configure Wireless Network (IEEE 802.11) Policies settings.

NOTE

The Wireless Network (IEEE 802.11) Policies Group Policy extension for Windows Server 2003 with SP1 does not support the configuration of WPA2 authentication settings.

Step 7: Installing Computer Certificates on Wireless Client Computers for EAP-TLS

For computer authentication with EAP-TLS, you must install a computer certificate on the wireless client computer.

To install a computer certificate on a wireless client computer running Windows Server 2003, Windows XP, or Windows 2000, connect to the organization intranet using an Ethernet port and do the following:

- If the domain is configured for autoenrollment of computer certificates, each computer that is a member of the domain requests a computer certificate when computer Group Policy is refreshed. To force a refresh of computer Group Policy for a computer running Windows Server 2003 or Windows XP, restart the computer or type **gpupdate /target:computer** at a command prompt. To force a refresh of computer Group Policy for a computer running Windows 2000, restart the computer or type **secedit /refreshpolicy machine_policy** at a command prompt.
- If the domain is not configured for autoenrollment, you can request a "Computer" certificate using the Certificates snap-in or you can execute a CAPICOM script to install a computer certificate.

The enterprise organization's information technology (IT) group can install a computer certificate before the computer, typically a laptop, is delivered to its user.

For information about CAPICOM, search for "CAPICOM" at http://msdn.microsoft.com/.

Step 8: Installing User Certificates on Wireless Client Computers for EAP-TLS

For user authentication with EAP-TLS, you must use a locally installed user certificate or a smart card. The locally installed user certificate must be obtained through autoenrollment, Web enrollment, by requesting the certificate using the Certificates snap-in, by importing a certificate file, or by running a CAPICOM program or script.

The easiest methods of installing user certificates assume that network connectivity already exists, such as using an Ethernet port. When the user connects to the intranet, they can obtain a user certificate through autoenrollment or by submitting a user certificate request using Web enrollment or the Certificate Manager. For more information about requesting a user certificate, see the "Submit a user certificate request via the Web" and "Request a certificate" procedures in this section.

Alternately, the user can run a CAPICOM program or script provided by the network administrator. The execution of the CAPICOM program or script can be automated through the user logon script.

If you have configured autoenrollment of user certificates, then the wireless user must update User Configuration Group Policy to obtain a user certificate.

If you are not using autoenrollment for user certificates, use one of the following procedures to obtain a user certificate.

Submit a user certificate request via the Web

1 Open Internet Explorer.

2 In Internet Explorer, connect to http://servername/certsrv, where *servername* is the name of the Windows 2000 Web server where the CA you want to access is located.

3 Click **Request a certificate**, and then click **Next**.

4 On the **Choose Request Type** Web page, under **User certificate request**, select the type of certificate you want to request, and click **Next**.

5 Do one of the following from the **Identifying Information** Web page: If you see the message "All the necessary identifying information has already been collected. You may now submit your request," click **Submit**. Enter your identifying information for the certificate request, and click **Submit**.

6 If you see the **Certificate Issued** Web page, click **Install this certificate**

7 Close Internet Explorer

Request a certificate

1 Open an MMC console that contains **Certificates – Current User**.

2 In the console tree, right-click **Personal**, then point to **All Tasks**, and then click **Request New Certificate** to start the Certificate Request wizard.

3 In the Certificate Request Wizard, select the following information: The type of certificate you want to request. If you have selected the **Advanced** check box:
   - **a** The cryptographic service provider (CSP) you are using.
   - **b** The key length (measured in bits) of the public key associated with the certificate.
   - **c** Do not enable strong private key protection.
   - **d** If you have more than one CA available, select the name of the CA that will issue the certificate.
4 Type a friendly name for your new certificate
5 After the Certificate Request Wizard has successfully finished, click **OK**

Floppy Disk-Based Installation

Another method of installing a user certificate is to export the user certificate onto a floppy disk and import it from the floppy disk onto the wireless client computer. For a floppy disk-based enrollment, perform the following:

1 Obtain a user certificate for the wireless client's user account from the CA through Web-based enrollment. For more information, see the "Submit a user certificate request via the Web" procedure previously described.
2 Export the user certificate of the wireless client's user account to a .pfx file. For more information, see the "Export a certificate" procedure in this section. Within the Certificate Manager Export wizard, export the private key and select **Delete the private key if the import is successful**. Save this file to a floppy disk and deliver it to the user of the wireless client computer.
3 On the wireless client computer, import the user certificate. For more information, see the "Import a certificate" procedure in this section.

Export a certificate

1 Open an MMC console containing **Certificates - Current User**.
2 Open **Personal**, and then open **Certificates**
3 In the details pane, right-click the certificate you want to export, point to **All Tasks**, and then click **Export**.
4 In the Certificate Export Wizard, click **Yes, export the private key**. (This option will appear only if the private key is marked as exportable and you have access to the private key.) Click **Next**.
5 Select **Personal Information Exchange – PKCS (.PFX)** as the export file format and click **Next**.
6 On the **Password** page, type a password in **Password** and **Confirm password** to protect the private key in the certificate and then click **Next**.
7 On the **File to Export** page, type the certificate filename or click **Browse** to specify the name and location of the certificate file. Click **Next**.
8 On the **Completing the Certificate Export Wizard** page, click **Finish**

Import a certificate

1 Open an MMC console containing **Certificates - Current User**
2 Open **Personal**, and then open **Certificates**.

3 In the details pane, right-click the certificate you want to export, point to **All Tasks**, and then click **Import**.

4 Type the file name containing the certificate to be imported. (You can also click **Browse** and navigate to the file.)

5 If it is a PKCS #12 file, do the following: Type the password used to encrypt the private key. (Optional) If you want to be able to use strong private key protection, select the **Enable strong private key protection** check box. (Optional) If you want to back up or transport your keys at a later time, select the **Mark key as exportable** check box.

6 Do one of the following: If the certificate should be automatically placed in a certificate store based on the type of certificate, select **Automatically select the certificate store based on the type of certificate**.

7 If you want to specify where the certificate is stored, select **Place all certificates in the following store**, click **Browse**, and select the certificate store to use.

Step 9: Configuring Wireless Clients for EAP-TLS

If you have configured Wireless Network (IEEE 802.11) Policies Group Policy settings and specified the use of EAP-TLS authentication (the **Smart Card or other Certificate** EAP type) for your wireless network, then no other configuration is needed for wireless clients running Windows XP with SP1, Windows XP with SP2, or Windows Server 2003.

To manually configure EAP-TLS authentication on a wireless client running Windows XP with SP1, Windows XP with SP2, or Windows Server 2003, do the following:

1 Obtain properties of the wireless connection in the Network Connections folder. Click the **Wireless Networks** tab, then click the name of the wireless network in the list of preferred networks and click **Properties**.

2 Click the Authentication tab and select Enable network access control using IEEE 802.1X and the Smart Card or other Certificate EAP type. This is enabled by default.

3 Click Properties. In the properties of the Smart Card or other Certificate EAP type, select Use a certificate on this computer to use a registry-based user certificate or Use my smart card for a smart card-based user certificate. If you want to validate the computer certificate of the IAS server, select **Validate server certificate** (enabled by default). If you want to specify the names of the authentication servers that must perform validation, select **Connect to these servers** and type the names.

4 Click **OK** to save changes to the Smart Card or other Certificate EAP type

To configure EAP-TLS authentication on a wireless client running Windows XP with no service packs installed, do the following:

1 Obtain properties of the wireless connection in the Network Connections folder. Click the **Authentication** tab, and then select **Enable network access control using IEEE 802.1X** and the **Smart Card or other Certificate** EAP type. This is enabled by default.

2 Click **Properties**. In the properties of the **Smart Card or other Certificate** EAP type, select **Use a certificate on this computer**. If you want to validate the computer certificate of the IAS server, select **Validate server certificate** (enabled by default). If you want to ensure that the server's DNS name ends in a specific string, select **Connect only if server name ends with** and type the string. For typical deployments where more than one IAS server is used, type the part of the DNS name that is common to all of the IAS servers. For example, if you have two IAS servers named

IAS1.example.microsoft.com and IAS2.example.microsoft.com, then type the string "example.microsoft.com". Ensure that you type the correct string, otherwise, authentication will fail.

3 Click **OK** to save changes to the Smart Card or other Certificate EAP type

To configure EAP-TLS authentication on a wireless client running Windows 2000 SP4, do the following:

1 Obtain properties of the wireless connection in the Dial-up and Network Connections folder. Click the **Authentication** tab, and then select **Enable network access control using IEEE 802.1X** and the **Smart Card or other Certificate** EAP type. This is enabled by default.

2 Click **Properties**. In the properties of the **Smart Card or other Certificate** EAP type, select **Use a certificate on this computer** to use a registry-based user certificate or **Use my smart card** for a smart card-based user certificate. If you want to validate the computer certificate of the IAS server, select **Validate server certificate** (enabled by default). If you want to specify the names of the authentication servers that must perform validation, select **Connect to these servers** and type the names.

3 Click **OK** to save changes to the Smart Card or other Certificate EAP type.

Step 10: Configuring Wireless Client Computers for PEAP-MS-CHAP v2

If you have configured Wireless Network (IEEE 802.11) Policies Group Policy settings and specified the use of PEAP-MS-CHAP v2 authentication for your wireless network (the **Protected EAP (PEAP)** type with the **Secured password (EAP-MSCHAP v2)** authentication method), then no other configuration for wireless clients running Windows XP with SP1, Windows XP with SP2, or Windows Server 2003 is needed.

To manually configure PEAP-MS-CHAP v2 authentication on a wireless client running Windows XP with SP1, Windows XP with SP2, or Windows Server 2003, do the following:

1 Obtain properties of the wireless connection in the Network Connections folder. Click the **Wireless Networks** tab, click the name of the wireless network in the list of preferred networks, and then click **Properties**.

2 Click the **Authentication** tab and select **Enable network access control using IEEE 802.1X** and the **Protected EAP** EAP type.

3 Click **Properties**. In the **Protected EAP Properties** dialog box, select **Validate server certificate** to validate the computer certificate of the IAS server (enabled by default). If you want to specify the names of the authentication servers that must perform validation, select **Connect to these servers** and type the names. In **Select Authentication Method**, click **Secured password (EAP-MSCHAP v2)**.

To configure PEAP-MS-CHAP v2 authentication on a wireless client running Windows 2000 SP4, do the following:

1 Obtain properties of the wireless connection in the Dial-up and Network Connections folder.

2 Click the Authentication tab and select Enable network access control using IEEE 802.1X and the Protected EAP EAP type.

3 Click Properties. In the Protected EAP Properties dialog box, select Validate server certificate to validate the computer certificate of the IAS server (enabled by default). If you want to specify the names of the authentication servers that must perform validation, select Connect to these servers and type the names. In Select Authentication Method, click Secured password (EAP-MSCHAP v2).

NOTE

By default, the PEAP-MS-CHAP v2 authentication uses your Windows logon credentials for wireless authentication. If you are connecting to a wireless network that uses PEAP-MS-CHAP v2 and you want to specify different credentials, click ***Configure*** *and clear the* ***Automatically use my Windows logon name and password*** *check box.*

Although the **Protected EAP Properties** dialog box for Windows XP with SP1, Windows XP with SP2, Windows Server 2003, and Windows 2000 SP4 has an **Enable Fast Reconnect** check box, IAS in Windows 2000 does not support fast reconnect. IAS in Windows Server 2003 does support fast reconnect.

If the root CA certificate of the issuer of the computer certificates installed on the IAS servers is already installed as a root CA certificate on your wireless clients, no other configuration is necessary. If your issuing CA is a Windows 2000 Server or Windows Server 2003 online root enterprise CA, then the root CA certificate is automatically installed on each domain member through computer configuration Group Policy.

To verify, obtain the properties of the computer certificate on the IAS server using the Certificates snap-in and view the certificate chain from the **Certification Path** tab. The certificate at the top of the path is the root CA certificate. Use the Certificates snap-in of a wireless client for each Windows operating system to ensure that this certificate is in the list of trusted root certification authorities in the Certificates (Local Computer)\Trusted Root Certification Authorities\Certificates folder.

If it is not, you must install the root CA certificate(s) of the issuer(s) of the computer certificates of the IAS servers on each wireless client for the Windows operating systems that do not contain them.

The easiest way to install a root CA certificate on all your wireless clients is to do the following:

1. Using the Certificates snap-in on an IAS server, export the root CA certificate of the issuing CA of computer certificates on the IAS servers to a file (*.PB7). You can find the root CA certificate in the Certificates (Local Computer)\Trusted Root Certification Authorities\Certificates folder.
2. Open the Active Directory Users and Computers snap-in.
3. In the console tree, double-click **Active Directory Users and Computers**, right-click the appropriate domain system container, and then click **Properties**.
4. On the **Group Policy** tab, click the appropriate Group Policy object (the default object is **Default Domain Policy**), and then click **Edit**.
5. In the console tree, open **Computer Configuration**, then **Windows Settings**, then **Security Settings**, and then **Public Key Policies.**
6. Right-click **Trusted Root Certification Authorities**, and then click **Import**
7. In the Certificate Import Wizard, specify the file that was saved in Step 1
8. Repeat steps 3-7 for all appropriate system containers

The next time the wireless client computers update their computer configuration Group Policy, the root CA certificate of the issuing CA of computer certificates on the IAS servers is installed in their local computer certificate store.

Alternately, you can use the Certificates snap-in to import the root CA certificates to the Certificates (Local Computer)\Trusted Root Certification Authorities\Certificates folder on each wireless client computer.

Additional Intranet Wireless Deployment Configurations

The section describes the following additional intranet wireless deployment configurations:

- Internet access for business partners
- Using a third-party CA
- Cross-forest authentication
- Using RADIUS proxies to scale authentications

Internet Access for Business Partners

The following is the behavior of most wireless APs in use today with respect to the receipt of RADIUS Access-Accept and Access-Reject messages:

- When the Altitude AP receives an Access-Accept message, the connection is allowed
- When the Altitude AP receives an Access-Reject message, the connection is denied

To allow a business partner, vendor, or other non-employee to gain access to a separate network using the same wireless infrastructure that allows employees to access to the organization intranet, the connection request must result in an Access-Accept message from the RADIUS server. To get an Access-Accept message from the RADIUS server, you must either use guest access or the business partner, vendor, or other non-employee must have a valid account and certificates.

Using Guest Access

Guest access occurs when wireless clients are connected without sending a user identity. The wireless client does not provide a user name or credentials to the Altitude AP. Therefore, the Altitude AP does not include user identity (the User-Name attribute) or credential attributes in the Access-Request message. When the IAS server receives an Access-Request message that contains no user identity or credentials attributes, it verifies whether unauthenticated access is enabled for the remote access policy that matches the connection attempt. If a user identity attribute is not included, the IAS server uses the Guest account to obtain user account dial-in properties and group membership. If a user identity attribute is included but credential attributes are not, the IAS server uses the indicated account to obtain user account dial-in properties and group membership.

Restricted network access for guest access clients is supported on wireless APs by using IP filtering or VLANs. To specify a virtual LAN identifier for unauthenticated access, configure the Tunnel-Type and Tunnel-Pvt-Group-ID attributes on the advanced properties of the appropriate remote access policy.

For more information about unauthenticated and guest access with IAS, see Windows 2000 Server Help or Windows Server 2003 Help and Support.

Using Validated Access

For validated access for business partners, vendors, or other non-employees, you must create computer and user accounts and issue certificates for each business partner, vendor, or other non-employee. Next, create groups with these accounts as members so that you can manage access using group-based remote access policies. For example, create a WirelessInternetUsers that contains global groups of business partner, vendor, or other non-employee user and computer accounts.

To configure a wireless remote access policy for Internet access for business partners, vendors, or other non-employees, create a new custom remote access policy for wireless Internet access with the following settings:

- Policy name: Wireless access to Internet (example)
- Conditions: NAS-Port-Type=Wireless-Other or Wireless-IEEE 802.11, Windows-Groups=WirelessInternetUsers
- Permissions: Select **Grant remote access permission**.
- Profile, **Authentication** tab: For Windows 2000 IAS, select **Extensible Authentication Protocol** and the **Smart Card or other Certificate** EAP type. Clear all other check boxes. If you have multiple computer certificates installed on the IAS server, click **Configure**, and then select the appropriate computer certificate. For Windows Server 2003 IAS, clear all other check boxes. Click **EAP Methods** and add the **Smart Card or other Certificate** EAP type. If you have multiple computer certificates installed on the IAS server, click **Edit**, and then select the correct computer certificate.
- Profile, **Encryption** tab: If the Altitude AP supports the MS-MPPE-Encryption-Policy and MS-MPPE-Encryption-Types RADIUS attributes, clear all other check boxes except the **Strongest** check box. This forces all wireless connections to use 128-bit encryption. If they are not, clear all the check boxes except **No encryption**.
- Profile, **Advanced** tab (if the Altitude AP supports VLANs):
  - Add the Tunnel-Type attribute with the value of "Virtual LANs (VLAN)".
  - Add the Tunnel-Pvt-Group-ID attribute with the value of the VLAN ID of the VLAN that is connected to the Internet.
- If the wireless APs require vendor specific attributes (VSAs), you must add the VSAs to the appropriate remote access policies. For more information, see the "Configure vendor-specific attributes for a remote access policy" procedure previously described.

Using a Third-Party CA

You can use third-party CAs to issue certificates for wireless access as long as the certificates installed can be validated and have the appropriate properties.

Certificates on IAS Servers

For the computer certificates installed on the IAS servers, the following must be true:

- They must be installed in the Local Computer certificate store.
- They must have a corresponding private key. When you view the properties of the certificate with the Certificate snap-in, you should see the text **You have a private key that corresponds to this certificate** on the **General** tab.
- The cryptographic service provider for the certificates supports SChannel. If not, the IAS server cannot use the certificate and it is not selectable from the properties of the **Smart Card or Other Certificate** EAP type from the **Authentication** tab on the properties of a profile for a remote access policy.
- They must contain the Server Authentication certificate purpose (also known as an Enhanced Key Usage [EKU]). An EKU is identified using an object identifier (OID). The OID for Server Authentication is "1.3.6.1.5.5.7.3.1".
- They must contain the fully qualified domain name (FQDN) of the computer account of the IAS server computer in the Subject Alternative Name property.

Additionally, the root CA certificates of the CAs that issued the wireless client computer and user certificates must be installed in the Certificates (Local Computer)\Trusted Root Certification Authorities\Certificates folder.

Certificates on Wireless Client Computers

For the user and computer certificates installed on wireless client computers, the following must be true:

- They must have a corresponding private key.
- They must contain the Client Authentication EKU (OID "1.3.6.1.5.5.7.3.2")
- Computer certificates must be installed in the Local Computer certificate store.
- Computer certificates must contain the FQDN of the wireless client computer account in the Subject Alternative Name property.
- User certificates must be installed in the Current User certificate store
- User certificates must contain the universal principal name (UPN) of the user account in the Subject Alternative Name property.

Additionally, the root CA certificates of the CAs that issued the IAS server computer certificates must be installed in the Certificates (Local Computer)\Trusted Root Certification Authorities\Certificates or Certificates (Current User)\Trusted Root Certification Authorities\Certificates folder.

Configuring Proxy Server Settings

Certificates issued from third-party CAs, such as VeriSign, Inc., can contain a certificate revocation list (CRL) uniform resource locator (URL) that points to an Internet Web site. If the IAS server cannot reach the Internet Web site to perform certificate revocation checking, it cannot validate the certificates of wireless clients for EAP-TLS authentication.

Many enterprise networks use a proxy server, such as Microsoft Internet Security and Acceleration Server (ISA), to access Internet services. Configuration of proxy server settings is normally done through Dynamic Host Configuration Protocol (DHCP) options. However, many IAS servers have a static IP address configuration and therefore might not be properly configured with the appropriate proxy server settings to access the Internet. The result is that IAS servers cannot perform certificate revocation checking for its own local computer certificate or wireless client certificates and authentication can fail for all wireless connections.

To configure an IAS server with the appropriate proxy server settings so that it can access Internet services, do the following:

1. On the IAS server, login using an account that has local administrator permissions.
2. Open a command prompt.
3. At the command prompt, type **time** and press ENTER.
4. At the **Enter the new time:** prompt, press ENTER.
5. At the command prompt, type **at** *[time+1 minute]***/interactive "cmd.exe"** and press ENTER. For example, if the current time from step 4 is 13:31, the command is **at 13:32/interactive "cmd.exe"**.
6. After a minute, a new command prompt opens. Commands run from this command prompt execute in the local system security context. IAS also runs in the local system security context. Therefore, you must configure proxy server settings from the local system security context so that they apply to IAS.

Otherwise, the proxy server settings only apply to the user account that was used to login to the IAS server in step 1.

7 From inside the new command prompt, type **"%programfiles%\Internet Explorer\Iexplore.exe"** (including the quotes) and press ENTER. This opens Internet Explorer in the local system security context.

8 Click **Tools**, and then click **Internet Options**.

9 Click the **Connections** tab, and then click **LAN Settings**.

10 In **Proxy server**, select **Use a proxy server for your LAN**.

11 Type the name or IP address of your proxy server in **Address**, then type the Web port number (typically 80) in **Port**. Example: if the name of your proxy server is CorpProxy and you use port 80 for your Web traffic, you would type **corpproxy** in **Address** and **80** in **Port**

12 Click **OK** to save the proxy server settings.

13 Click **OK** to close the **Internet Options** dialog box.

14 Close Internet Explorer.

15 Close the new command prompt that was opened in step 6.

Another way to configure proxy server settings is to use the ProxyCfg.exe tool from the command prompt opened in step 6. ProxyCfg.exe is included with Windows Server 2003. For a version of ProxyCfg.exe that works with Windows 2000 Server, see 830605 - The Proxycfg.exe configuration tool is available for WinHTTP 5.1. For more information about how to use ProxyCfg.exe, see ProxyCfg.exe, a Proxy Configuration Tool.

5 Windows Recommendations and Best Practices

The following are recommendations and best practices for deploying an IEEE 802.11 WLAN in a large enterprise.

Security

Microsoft recommends that you use one of the following combinations of security technologies (in order of most to least secure):

- **WPA2 with EAP-TLS and both user and computer certificates** - EAP-TLS is the strongest 802.1X authentication method supported by Windows-based wireless clients. For the highest security, configure your PKI to issue both user and computer certificates for wireless access.
- **WPA2 with PEAP-MS-CHAP v2 and require strong user passwords -** If a PKI deployment is not possible or desirable, you can use PEAP-MS-CHAP v2. PEAP-MS-CHAP v2 can be used to provide strong password-based authentication of wireless clients, but only when used in conjunction with the requirement of strong user password policies on your network.
- **WPA with EAP-TLS and both user and computer certificates -** If your wireless equipment supports WPA but not WPA2, use WPA with EAP-TLS.
- **WPA with PEAP-MS-CHAP v2 and require strong user passwords** - If your wireless equipment supports WPA but not WPA2 and you do not want to deploy a PKI, use WPA with PEAP-MS-CHAP v2.

The following combinations of security technologies (in order of most to least secure) are discouraged from use except if used temporarily when transitioning to a WPA2 or WPA-based security configuration:

- **WEP with 802.1X authentication, EAP-TLS with both user and computer certificates, and periodic reauthentication** - If your wireless equipment does not support WPA2 or WPA, you can use WEP with EAP-TLS-based 802.1X authentication and both user and computer certificates. To change the per-client WEP encryption key for a wireless client session, force your wireless clients to periodically reauthenticate by configuring your wireless APs or RADIUS-based authentication servers.
- **WEP with 802.1X authentication, PEAP-MS-CHAP v2, periodic reauthentication, and enforce strong user passwords** - If your wireless equipment does not support WPA2 or WPA and you are not deploying a PKI, you can use the combination of WEP, 802.1X, and PEAP-MS-CHAP v2. However, you must also require strong user passwords and force your wireless clients to periodically reauthenticate.

PKI

For the certificates used for wireless access, use the following best practices:

- To install computer certificates, use auto-enrollment - This requires the use of a Windows 2000 or Windows Server 2003 Certificate Services server as an enterprise CA at the issuer CA level.

- To install user certificates, use auto-enrollment - This requires the use of a Windows Server 2003, Enterprise Edition, or Windows Server 2003, Datacenter Edition, Certificate Services server as an enterprise CA at the issuer CA level.
- Otherwise, to install user certificates, use a CAPICOM script - Alternately, use a CAPICOM script to install both computer and user certificates.
- Because certificate revocation checking can prevent wireless access due to the unavailability or expiration of CRLs for each certificate in the certificate chain, design your PKI for high availability of CRLs. For instance, configure multiple CRL distribution points for each CA in the certificate hierarchy and configure publication schedules so that the most current CRL is always available

Altitude APs

When choosing and deploying Altitude APs, use the following best practices:

- Use Altitude APs that support WPA2 or WPA. If you must use Altitude APs that support only WEP, ensure that they support 802.1X, 128-bit WEP, and the use of both multicast/global and unicast session encryption keys.
- Change the administration configuration of the Altitude AP, such as administrator-level user names and passwords, from its default configuration.
- If you are installing Altitude APs in the plenum area, the space between the ceiling tiles and the ceiling, you must obtain plenum-rated Altitude APs to comply with fire safety codes.
- To minimize cross talk on the 802.11b wireless frequencies in the S-Band ISM frequency range, overlapping coverage areas should have a five-channel separation. For example, in the United States, use channels 1, 6, and 11.
- If you are using SNMP to manage or configure Altitude APs, change the default SNMP community name. If possible, use Altitude APs that support SNMPv2.

Wireless Network Adapters

When choosing and deploying wireless network adapters, use the following best practices:

- Use wireless network adapters whose drivers support Windows XP Wireless Auto Configuration.
- Use wireless network adapters that support WPA2 or WPA. If you must use wireless network adapters that support only WEP, ensure that they support 128-bit WEP encryption keys and both multicast/global and unicast session keys.
- Avoid installing wireless configuration tools that are provided with the wireless network adapter and use Windows XP Wireless Auto Configuration.
- For easier deployment, use wireless network adapters that have Plug and Play drivers already included with Windows XP or are available through Windows Update (http://www.windowsupdate.com).

Active Directory

When configuring Active Directory for wireless access, use the following best practices:

- If you have a native-mode domain and are using a group-based wireless remote access policy, use universal groups and global groups to organize your wireless accounts into a single group. Additionally, set the remote access permission on computer and user accounts to **Control access through Remote Access Policy**.
- If you are using a Windows 2000 enterprise CA as an issuing CA, use the Computer Configuration **Automatic Certificate Request Settings** Group Policy setting to automatically issue computer certificates to all domain members. Ensure that all appropriate domain system containers are configured for automatic enrollment of computer certificates, either through the inheriting of group policy settings of a parent system container or explicit configuration.

RADIUS

When deploying your RADIUS infrastructure for wireless access, use the following best practices:

- If supported by your wireless APs, use Internet Protocol security (IPsec) and Encapsulating Security Payload (ESP) to provide data confidentiality for RADIUS traffic between the Altitude AP and the IAS servers and between IAS servers. Use 3DES encryption and, if possible, certificates for Internet Key Exchange (IKE) main mode authentication. IPsec settings for RADIUS traffic sent between IAS servers can be configured using Group Policy and assigned at the Active Directory system container level. For more information about IPsec, see the Windows Server 2003 IPsec Web site (http://www.microsoft.com/windowsserver2003/technologies/networking/ipsec/default.mspx)
- To provide the maximum security for unprotected RADIUS traffic, choose RADIUS shared secrets that are random sequences of upper and lowercase letters, numbers, and punctuation at least 22 keyboard characters long. If possible, use a random character generation program to determine shared secrets to configure on the IAS server and the Altitude AP.
- Use as many different RADIUS shared secrets as possible. The actual number of RADIUS shared secrets depends on configuration constraints and management considerations. For example, IAS allows the configuration of RADIUS shared secrets on a per-client or per-server basis. However, many wireless APs allow for the configuration of a single RADIUS shared secret for both primary and secondary RADIUS servers. In this case, a single RADIUS shared secret is used for two different RADIUS client-RADIUS server pairs: the Altitude AP with its primary RADIUS server and the Altitude AP with its secondary RADIUS server. Additionally, if you are using the **netsh aaaa show** and **netsh exec** commands to copy the configuration of one IAS server (the primary) to another (the secondary), the RADIUS shared secret for each Altitude AP/primary IAS server pair must be the same as the RADIUS shared secret for each Altitude AP/secondary IAS server pair. Because the Windows Server 2003, Enterprise Edition, and Windows Server 2003, Datacenter Edition versions of IAS allows you to configure a range of IP addresses to define a single RADIUS client (for example, all the wireless APs on a single subnet in a single building at Microsoft), all the Altitude AP/IAS server pairs defined by the IAS RADIUS client are configured with the same RADIUS shared secret.
- When there are separate account databases, such as different Active Directory forests or domains that do not have two-way trusts, you must use a RADIUS proxy between the wireless APs and the RADIUS servers that are providing the authentication and authentication processing. Windows Server 2003 IAS supports RADIUS proxy functionality through the configuration of connection request policies and remote RADIUS server groups. For this example, connection request policies are created to match different portions of the User-Name RADIUS attribute corresponding to each

account database (such as different Active Directory forests). RADIUS messages are forwarded to a member of the corresponding remote RADIUS server group matching the connection request policy.

- Investigate whether the wireless APs need RADIUS vendor-specific attributes (VSAs) and configure them during the configuration of the remote access policy on the **Advanced** tab of the remote access policy profile.

Scalability

When designing for scalability, use the following best practice:

- For a large amount of authentication traffic within an Active Directory forest, use a layer of RADIUS proxies running Windows Server 2003 IAS between the wireless APs and the RADIUS servers.
- By default, an IAS RADIUS proxy balances the load of RADIUS traffic across all the members of a remote RADIUS server group on a per authentication basis and uses failover and failback mechanisms. Members of a remote RADIUS server group can also be individually configured with priority and weight settings so that the IAS proxy favors specific RADIUS servers.

Using Computer-only Authentication

Some network administrators want to use only computer authentication. By using only computer authentication, a wireless client computer must perform computer-level 802.1X authentication with an Altitude AP using either a computer certificate (when using EAP-TLS authentication) or the computer's account name and password (when using PEAP-MS-CHAP v2 authentication) before it can access the organization network. With computer-only authentication, only valid computers can connect to the wireless network. Computers that do not have a computer account in the organization's domain cannot connect. This prevents users from bringing computers from home and connecting to the organization's wireless LAN. Home computers represent a threat to the organization network because they are not managed in the same way as member computers and can introduce viruses or other malicious programs into the organization network.

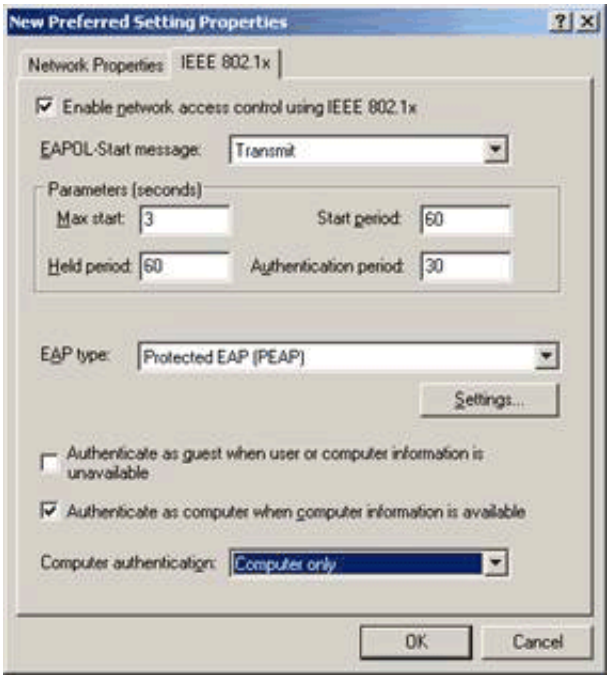
For more information about computer authentication and user authentication, see "Windows XP Wireless Deployment Technology and Component Overview" at http://www.microsoft.com/technet/prodtechnol/winxppro/maintain/wificomp.mspx.

You can configure computer-only authentication using the Wireless Network (IEEE 802.11) Policies Group Policy extension or through the registry.

Configuring Computer-only Authentication using the Wireless Network (IEEE 802.11) Policies Group Policy Extension

To configure computer-only authentication using the Wireless Network (IEEE 802.11) Policies Group Policy extension, select Computer only in Computer authentication on the 802.1X tab for the preferred network the corresponds to your wireless network. Figure 4 shows an example.

Figure 6: Selecting computer-only authentication in the Wireless Network (IEEE 802.11) Policies Group Policy extension



For more information, see Configuring Wireless Settings Using Windows Server 2003 Group Policy at http://www.microsoft.com/technet/community/columns/cableguy/cg0703.mspx.

Enabling Computer-only Authentication Using the Registry

To configure computer-only authentication through the registry, all the Windows-based wireless clients must have the following registry value set:

```
HKEY_LOCAL_MACHINE\Software\Microsoft\EAPOL\Parameters\General\Global\AuthMode=2
```

With the AuthMode setting set to 2, only computer authentication is attempted. User authentication is never attempted.

To add this registry setting on all of your computers running Windows, you can use the following tools:

- Regini.exe from the Windows 2000 Server Resource Kit Tools
- Reg.exe from the Windows Server 2003 Resource Kit Tools

In both cases, you create a script file that is read by the tool to add a registry setting. The tool has to be run in the security context of a local administrator account.

Alternately, you can use network management software to change registry settings on managed computers

Summary

You can perform secure wireless authentication with either EAP-TLS or PEAP-MS-CHAP v2. For EAP-TLS, you must deploy a certificate infrastructure capable of issuing computer certificates to your IAS servers and both computer and user certificates to your wireless client computers and users. For PEAP-MS-CHAP v2, you only need to install computer certificates on the IAS servers, provided that the appropriate root CA certificates are already installed on the wireless clients. For both cases, you must manage your Active Directory users and groups for wireless access, configure your IAS servers as RADIUS servers to the wireless APs, and configure your wireless APs as RADIUS clients to the IAS servers. You can also configure Internet access for business partners, use third-party CAs, and use IAS RADIUS proxies for cross-forest authentication or load balancing.

6 Summit WM Controller diagnostics

WARNING!

Changes or modifications made to the Summit WM Controller or the Wireless APs which are not expressly approved by Extreme Networks could void your service contract.
Only authorized Extreme Networks service personnel are permitted to service the system. Procedures that should be performed only by Extreme Networks personnel are clearly identified in this guide.

Summit WM Controller WM200/2000 diagnostics

Summit WM Controller WM200/2000 capacity

The Summit WM Controller WM200/2000 has the following capacities:

- 1GB of secondary storage
- 4 partitions
- Separate partitions for logging and application storage (backup images, image storage for the Summit WM Controller and Wireless APs.

Table 13 shows the filesystem capacities for the Summit WM Controller WM200/2000.

Table 13: Summit WM Controller WM200/2000 filesystem capacity

Filesystem	Size	Comment
/	600MB	Main partition – Installs OS, User accounts, application components, system logs
/var/controller/images	200MB	Storage area for system related images – Application RPM, OSUpdate packages, AP images
/var/controller/log	128MB	Stores application related logs
/var/controller/cdr	32MB	Stores user CDRs
/tmp	128MB	Memory mapped filesystem for quick IO operations off Flash

NOTE

A separate rescue partition is also installed providing a method of rescue installation.

Summit WM Controller WM200/2000 license capacity

The Summit WM200 Controller has a base capacity of 50 APs. With a capacity upgrade license, it can support up to 100 APs. The Summit WM2000 Controller has a base capacity of 100 APs. With a capacity upgrade license, it can support up to 200 APs.

Table 14 shows the system capacities for each license.

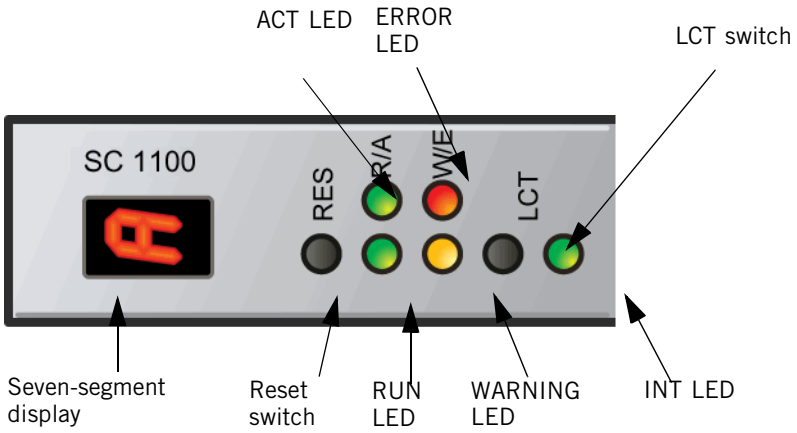
Table 14: Summit WM Controller WM200/2000 system capacity

	WM200	WM2000
Number of APs	100 (50 as shipped with base license; 50 with capacity upgrade license)	200 (100 as shipped with base license; 100 with capacity upgrade license)
Number of Users	2048	4096
Number of WM-Access Domains	32	64
Number of Voice calls	200	500
Maximum Throughput	2Gbps	2Gbps
Part Number	15955: Controller with base license	15956 – Controller with base license

Summit WM Controller WM200/2000 LEDs

The SC1100 is the main entity in charge of system monitoring and state reporting. The LED states for the card represent the system states.

Figure 7: System LED diagram



The reported states for the Summit WM Controller WM200/2000 are:

- **Run LED** – This indicator indicates CPU activity. Once CPU initialization is complete, the Run LED blinks with CPU activity.
- **Activity LED** – This indicator will be turned on upon application (SMT) start. It indicates that the system in now under application control. It also indicates health monitor for app/system initialization and provides a reset context for error codes.
- **Warning/Error LED** – The Yellow (Warning) and Red (Error) indicators are ALARM LEDs signalling a problem state. These LEDs are used by the application to indicate the running state of the system. The corresponding error code is displayed in the SSD and a corresponding error alert is provided in through the Log system.

The Seven-Segment Display (SSD) is used to provide information about startup or processor load.

NOTE

The error codes represented by the SSD are context dependent on the state of the LEDs (ACT, W, E).

Summit WM Controller WM200/2000 LED states and Seven Segment Display (SSD) codes

Firmware initialization:

Table 15: LED states and SSD codes during firmware initialization

Active LED	Warning LED	Error LED	SSD Codes	Condition
Green			0	The processor has started; and the firmware has taken control.
Green			3	The Host Supervisor Card has failed to download Bootloader from Flash.
Green			4	The system is checking firmware consistency.
Green			5	The system is formatting memory.
Green			6	The system is initializing load device. Note: If the SSD code is stuck at 6 for more than a minute, it implies that the Network Processor Card is installed in wrong slot.
Green			9	The system is loading subsystem.
Green			b	The system is starting the operation system. The system is active.

NOTE

Although the Active LED will be lit Green during the firmware initialization, this LED state is irrelevant to the SSD display or the condition. You must ignore the LED state during the firmware initialization.

Application initialization:

Table 16: LED states and SSD codes during application initialization

Active LED	Warning LED	Error LED	SSD Code	Condition
Green			0	Application initialization started.
Green			C	System configuration in progress.
Green			1	Preparing Forwarding Engine initialization.
Green			2	Initializing Forwarding Engine
Green			3	Forwarding Engine initialization complete. Application initialization.
Green			A	Application initialization complete. System active.
Green			H	System halted. Administrator requested halting of system.

Warning conditions:

Table 17: LED states and SSD codes during warning conditions

Active LED	Warning LED	Error LED	SSD Code	Condition
Green	Yellow		1	High temperature reached.
Green	Yellow		2	Fan unit failure. Rotation counter indicates zero speed for one of the lateral trays. May be the result of fan tray removal.
Green	Yellow		3	Power supply failure. Failed to detect one of the power supplies. May be the result of the fan tray removal of one of the power supplies.
Green	Yellow		4	FDD low sector count (40 backup sectors remaining).
Green	Yellow		5	FDD extremely low sector count (20 backup sectors remaining)

Error conditions:

Table 18: LED states and SSD codes during error conditions

Active LED	Warning LED	Error LED	SSD Code	Condition
Green		Red	1	Failed to identify FDD. Possibly due to removal of FDD card.
Green		Red	2	Failed to initialize NPE card.
Green		Red	3	Critical threshold reached (95C for NPE). The system will reboot.
Green		Red	4	Full fan assembly failure (both trays). The system will reboot.
Green		Red	5	Application initialization failure. Startup manager failed to initialize all the components of the system. The system will reboot.
Green		Red	6	Lost connectivity with Ethernet interface. Possible failure of NPE card. The system will reboot.
Green		Red	7	MF 1000 card failure. Backup sectors exhausted.
Green		Red	8	NP 4000 card initialization failure. Firmware self test (BIST) has detected failure in one or more components (memory, bus, interconnects)

System Startup

The firmware and bootloader procedures execute the system startup phase. Table 19 provides SSD descriptions.

Table 19: SSD definitions

SSD	Description
0	The processor has started. The firmware has taken control. This SSD is short and rarely in running systems.
4	Check Firmware consistency, ev. update
5	Format Memory
6	Initialize load device
9	Load subsystem
b	Start operating System, System active

The SSD b is displayed to indicate that the OS has started. This is followed by multiple subsystem specific information signs. Each sign represents a subsystem in ascending order. When everything is OK, the display returns to SSD b.

In case of an error during startup, an E with a numeric error-code flashes on the SSD to identify the error.

Summit WM Controller WM200/2000 application states

The Activity LED becomes active to indicate that the system has completed startup diagnostic procedures (POST), and the OS has properly loaded. The Act LED indicates that the Summit WM Convergence Software is running. The corresponding running state of the application is indicated in the SSD. All other LEDs default to off, unless otherwise specified. The Activity, Minor/Major, INT and SSD are available to report running codes.

Table 20: Summit WM Controller WM200/2000 application states

Condition	Log Level	Comment	Action
Activity LED			
Application initialization started. • Activity LED = Enabled • SSD= 0	Syslog	Application has initialized and began to load system components.	No Action Required
Forwarding Engine initialization complete. Application initializing. • Activity LED = Enabled • SSD= 1	Major	FE initialization complete	No Action Required
Application initialization complete. System active. • Activity LED = Enabled • SSD= A	Major	Complete set of application components have restarted. System is now ready to enter active state.	No Action Required

Table 20: Summit WM Controller WM200/2000 application states (Continued)

Condition	Log Level	Comment	Action
System halted. Administrator requested halting of system. • Activity LED = Enabled • SSD= H	Major	This SSD code indicates that the administrator has requested the halting of system's operations. The system is in halted state.	Reset system power to restore operational state.
Warning LED			
High Temperature reached • Activity LED = Enabled • Warning LED = Enabled • Alarm = MAJOR • SSD= 1	Major (set) Info (reset)	Temperature in one of the system's sensors has reached high threshold notification of occurrence.	Check speed/state indicators for FANs. Check for proper airflow access. If problem persists, contact Technical Support.
Fan unit failure. Rotation counter indicates Zero speed for one of the lateral trays. May be result of tray removal. • Activity LED = Enabled • Warning LED = Enabled • Alarm = MINOR • SSD= 2	Minor	Rotation counter for Fan indicates Zero for one of the lateral trays. May also be the result of fan tray removal (hot swap) System is at risk of over-heating.	Re-insert fan tray. If card present, contact Technical Support.
Power supply failure. Failed to detect one of the power supplies, may have been removed. • Activity LED = Enabled • Warning LED = Enabled • Alarm = MAJOR • SSD= 3	Major	Failure Detected for one of the power supplies	Re-insert power block. If block present, contact Technical Support.
FDD low sector count (40 backup sectors remaining). • Activity LED = Enabled • Warning LED = Enabled • Alarm = MAJOR • SSD= 4	Major	Media Storage utilization has only 40 free blocks available leveling. Card is getting close to max sector re-use	Contact Technical Support to arrange replacement.
FDD extremely low sector count (20 backup sectors remaining). • Activity LED = Enabled • Warning LED = Enabled • SSD= 5	Major	Media Storage utilization has reached critical level of free sector utilization. No more free-sectors available. - Recommend replacement.	Contact Technical Support to arrange replacement.

Table 20: Summit WM Controller WM200/2000 application states (Continued)

Condition	Log Level	Comment	Action
Error LED			
Failed to identify FDD. Possibly due to removal of FDD card. • Activity LED = Enabled • Warning LED = Enabled • Error LED = Enabled • SSD= 1			Re-insert card. If card present, contact Technical Support to arrange replacement.
Failed to initialize NPE card. • Activity LED = Enabled • Warning LED = Enabled • Error LED = Enabled • SSD= 2			Re-insert card. If card present, contact Technical Support to arrange replacement.
Critical threshold reached (95C for NPE). System will reboot. • Activity LED = Enabled • Warning LED = Enabled • Error LED = Enabled • SSD= 3			Check speed/state for fans. Check for proper airflow access. If problem persists, contact Technical Support.
Full fan assembly failure (both trays). System will reboot. • Activity LED = Enabled • Warning LED = Enabled • Error LED = Enabled • SSD= 4			Re-insert fan tray. If card present, contact Technical Support to arrange replacement.
Application initialization failure. Startup manager failed to initialize all of system's components. system will reboot. • Activity LED = Enabled • Warning LED = Enabled • Error LED = Enabled • SSD= 5			If problem persists, contact Technical Support.
Lost connectivity with FE. Possible failure of NPE card. System will reboot. • Activity LED = Enabled • Warning LED = Enabled • Error LED = Enabled • SSD= 6			Investigate failure condition in `/var/controller/log/logs/ixcapture.log` If problem persists, contact Technical Support.

Table 20: Summit WM Controller WM200/2000 application states (Continued)

Condition	Log Level	Comment	Action
MCE failure. Backup sectors exhausted. • Activity LED = Enabled • Warning LED = Enabled • Error LED = Enabled • SSD= 7			Contact Technical Support to arrange replacement.
NPE Initialization Failure. Firmware self test (BIST) has detected failure with one component (memory, bus, interconnects) • Activity LED = Enabled • Warning LED = Enabled • Error LED = Enabled • SSD= 8			Contact Technical Support to arrange replacement.

SNMP Alarms are generated for each of the conditions corresponding to Major and Critical logs.

Summit WM Controller WM200/2000 protocols

The Summit WM software uses several protocols. All the protocols are IP based protocols, and as a result have corresponding TCP and UDP ports associated with them. You must note the TCP/UDP ports that are required for the proper functioning of the Summit WM Controller and the Wireless APs.

The following table specifies the protocol ports:

Table 21: Protocols and Ports

Component		Protocol (TCP/UDP)	Src Port	Dst Port	Service	Remarks
Source	Destination					
	Access Point	UDP			CTP	
	Controller	TCP/UDP	Any	22	SSH	Management
	Controller	TCP	Any	5825	HTTPS	
	Controller	TCP/UDP	Any	161	SNMP	
Controller		TCP/UDP	32768-65535			Outgoing connection from the Controller to various devices.
Controller	Access Point	UDP	Any	13910 (Subject to NAPT)	CTP	WLAN data and control tunnel.
Access Point	Controller	UDP	Any	13910	CTP	WLAN data and control tunnel
Access Point	Controller	UDP		13907	RU Registration	

Table 21: Protocols and Ports (Continued)

Component		Protocol (TCP/UDP)	Src Port	Dst Port	Service	Remarks
Source	Destination					
Controller	Controller	TCP(UDP)		13911	BM (AC) Availability	
Controller	Access Point	TCP/UDP		69	TFTP	
Access Point	Controller	TCP/UDP		69	TFTP	Used for Access Point software update
Router	Controller	OSPF			OSPF	Routing Protocol
DHCP Server	Controller	UDP	Any	67-68	DHCP	DHCP communications such as DHCP relay or informs.
Controller	Controller	TCP	Any	427	SLP	For Device Discovery
Network Devices	Controller	ICMP				Allow ICMP Ping/trace route etc.
Controller	Controller	TCP	Any	20505	Inter-Controller Langley	Used by INS (Rogue AP Detection) to talk to each Controller's RF Data Collector (RFDC)
Network Devices	Access Point	TCP	Any	23	Telnet	Basic Management
DHCP Server	Access Point	UDP	Any	68	DHCP	Client IP addressing
Network Management Server	Controller	TCP	Any	22	SSH, SFTP	CLI access, Secure FTP server
Network Management Server	Controller	TCP	20, Any	20, 21	FTP	FTP client (Image download, Backup uploads)
Controller	Controller	UDP		123	Network time	synchronizing the clocks of computer systems over packet-switched data networks

Summit WM Controller WM20 diagnostics

Summit WM Controller WM20 capacity

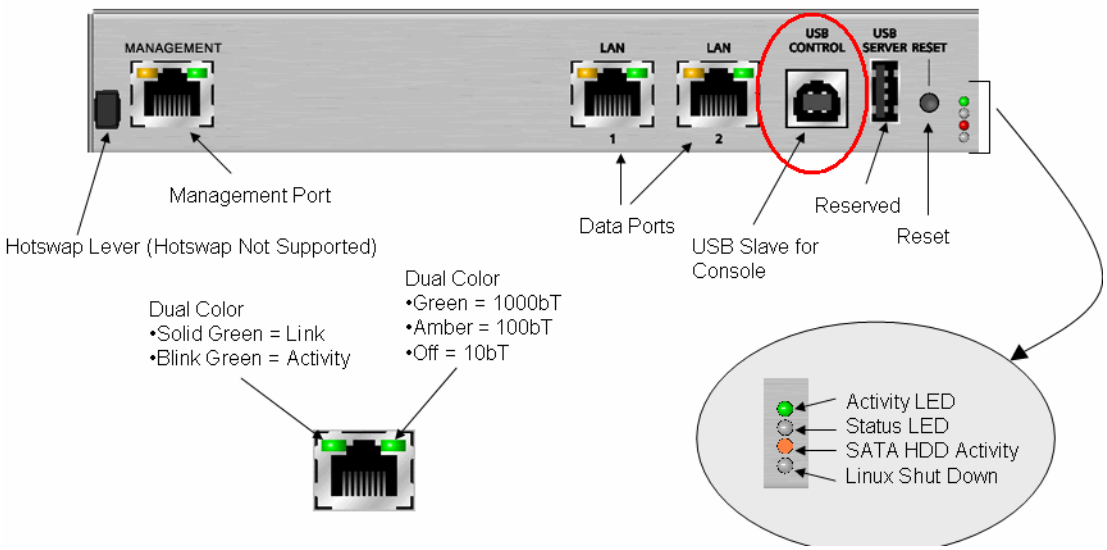
Table 22 shows the filesystem capacity for the Summit WM Controller WM20.

Table 22: Summit WM Controller WM20 filesystem capacity

Filesystem	Size	Comment
/	21 GB	Main partition for OS and application installation
/home	1.9 GB	User Accounts
/var/log/controller/cdr	1.9 GB	Accounting CDRs
/var/log/controller/logs	1.4 GB	Application logs
/var/log/controller/reports	1.4 GB	System reports
/var/log/controller/trace	1.4 GB	System tracing
/var/controller.upgrade	4.9 GB	System image storage (Wireless APs, Controller, OS updates)
/rescue	1.0 GB	

Using the console port

Connect to the console port of the Summit WM20 Controller to perform diagnostics or a rescue procedure. The Summit WM20 Controller does not directly expose a DB9 COM interface. Instead, serial console access is provided through the USB Control port as a USB connection. The connector is reserved for Serial-over-USB operation.



To connect to the console port:

1 Install the virtual serial driver by Silicon Laboratories Inc. on the laptop. You only need to install the serial driver once. You do not need to repeat installing the software each time you connect to the port.

2 The CP210x USB to UART Bridge VCP drivers are provided by Silicon Laboratories Inc. Depending on the OS of your computer, click on the appropriate "VCP Driver Kit" link on the web page given below. Note that this URL is subject to change.

https://www.silabs.com/products/mcu/Pages/USBtoUARTBridgeVCPDrivers.aspx

3 With a normal USB (male A/B) cable, connect the B end to the Summit WM20 Controller and the A end to the laptop. The driver recognizes the connection and installs a serial device (Com #).

To determine the actual number assigned to the device, navigate to **Control Panel** > **System** > **Hardware** > **Device Manager** > **Ports (COM & LPT)**.

4 Using a terminal program of choice (for example, Hyperterm) establish a connection to the Summit WM20 Controller using the corresponding COM device.

The connection settings are 9600 8N1 no flow (9600 bps, 8 bits, no parity, 1 stop bit, no flow).

Summit WM Controller WM20 rescue procedure

The Summit WM20 Controller provides a separate rescue partition on which a minimal copy of the kernel is installed. The partition is accessed as a special mode of the system's bootloader. Rescue mode boots into the rescue partition, loads the minimal kernel and corresponding filesystem. It also mounts the primary system partitions as locally accessed mount-points. The user is then presented with a menu as to how the system's rescue is to proceed.

CAUTION

If the HDD has failed, use the Rescue procedure to revert to your previous image. You must first replace the corrupted HDD with a new one that has the factory default image on it. You can then use the Rescue procedure to revert to your previous image with your old configurations.

The Summit WM Controller WM20 supports the following methods for rescue:

- **Local** – Rescue file is directly present on filesystem
- **Remote** – Rescue file is located in a remote FTP server

Local rescue

The rescue partition contains a rescue image. The rescue image is typically installed at manufacturing time, during the image cloning process. The user can select the Local rescue method to utilize the local stored file as the rescue image.

Remote rescue

The remote method allows the user to directly install the rescue image as part of the download process. By default the remote image is not stored in the local partition. The user is given the option to save downloaded rescue image into the partition.

Summit WM Controller WM20 capacity

Table 23 shows the system capacities for the Summit WM20 Controller.

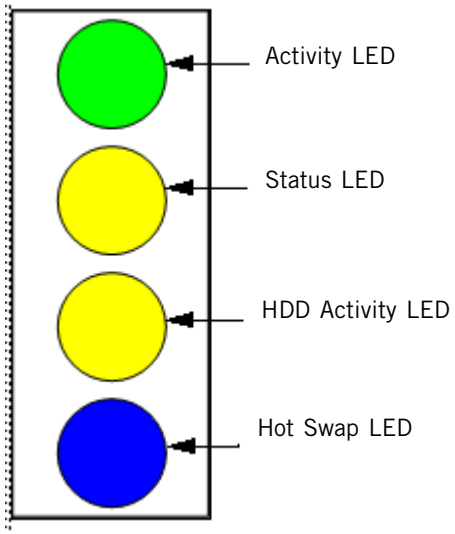
Table 23: Summit WM Controller WM20 capacity

	Summit WM Controller WM20
Number of APs	32
Number of APs – Local and Foreign (Availability)	64
Number of Users	512 + 512
Number of WM-AD	8
Number of Voicecalls	Minimum 61 (Simultaneous users/calls)
Maximum Throughput	200 Mbps over the two1000BT interfaces for mixed traffic Internet distribution of packet sizes

Summit WM Controller WM20 LEDs

The Summit WM Controller WM20 has four LEDs on its front panel.

Figure 8: Summit WM Controller WM20 LEDs



The description of the LED states is provided below:

- **ACTIVITY LED** – Indicates the CPU activity, including the amount of traffic carried to and from the Wireless APs.
- **STATUS LED** – Indicates the normal state of the Summit WM Controller as seen by the system's software. This LED covers all stages of the Summit WM Controller, ranging from restarting, to shutting-down. As long as the Summit WM Controller is running normally, this LED will remain lit.
- **HDD Activity LED** – Is hardware controlled to report Hard Drive Device (HDD) activity.
- **Hot Swap Button LED** – Indicates that the hot swap lever on the Summit WM Controller is pulled out.

NOTE

The hot swap lever is not enabled in the current release. Pulling the hot swap lever will not affect the normal operation if the Summit WM Controller WM20 is already running. However, if you attempt to reboot the Summit WM Controller WM20 with the hot swap lever pulled out, the controller will fail to reboot. If you pull the hot swap lever while the Summit WM Controller WM20 is in operation, the Hot Swap LED will light up.

Summit WM Controller WM20 LED states and corresponding system states

Table 24: Summit WM Controller WM20 LED states and corresponding system states

System state	Status LED	Activity LED
Power up (BIOS, POST)	Blinking Amber	Green
System booting (failed to boot)	Off	Green
Startup Manager: Task Started	Solid Amber	Blinking Amber
Startup Manager: Task completes the startup — All components active	Solid Green	Blinking Green upon traffic activity
A component fails to start or needs restarting (Startup Manager Task retrying that component)	Solid Amber	Blinking Green
Possible hardware failure (Fan, temperature)	Green	Blinking Red
A component fails (no more retries)	Solid Red	Off
System about to reset by the watchdog	Blinking Red	Off
System shutdown/halt (Requires manual reboot)	Solid Red	Solid Red

NOTE

LED 3 – HDDActivity LED – Orange/Amber
- *HDDActivity LED is off when HDD is not in use*
- *HDDActivity LED is on when HDD is in use*

LED 4 – Hot Swap LED – Blue
- *Solid Blue when the hot swap lever is pulled out*

Summit WM Controller WM20 protocols

The Summit WM Controller WM20 uses similar protocols to the Summit WM Controller WM200/2000. For more information, see "Summit WM Controller WM200/2000 protocols" on page 74.

7 Hardware maintenance

Summit WM Controller WM200/2000 maintenance

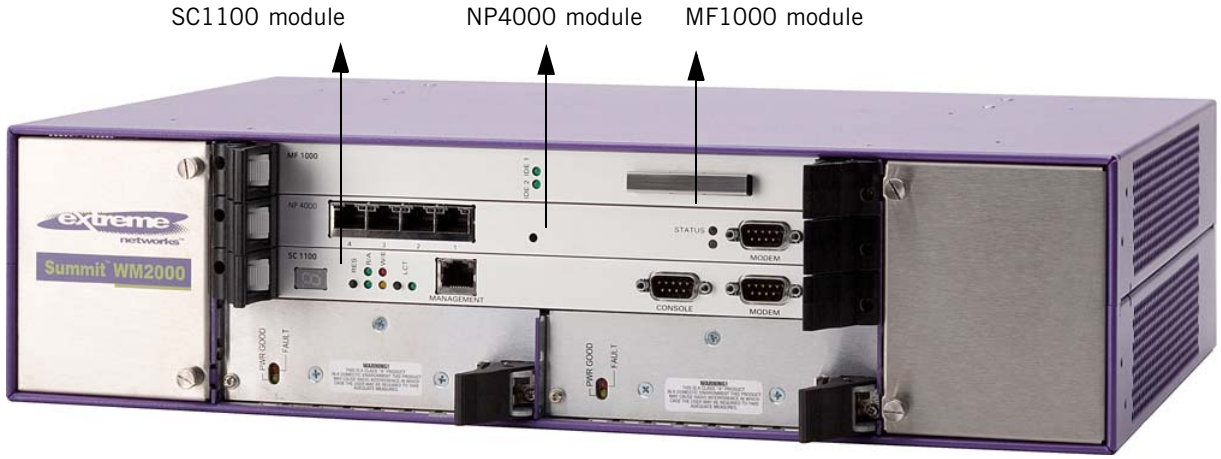
WARNING!

The Summit WM Controller WM200/2000 system may not be operated in a LAN in which a DC voltage is overlaid on the data lines, since there are still switches that connect directly without checking the supply voltage first. Depending on the transformer at the LAN interface, voltages of up to 500 V can be induced. Such peak voltages usually lead to destruction of the physical LAN controller's logic.

Summit WM Controller WM200/2000 (Figure 9) consists of a cassette with a cPCI backplane, NP4000 Blade, MF1000 Blade module, SC1100 Module, a universal power supply unit, and redundant fan modules.

There is no electrical connection between the access point and the Summit WM Controller WM200/2000. The Summit WM Controller WM200/2000 and Altitude APs communicate with each other exclusively via the IP network. For more information, see the *Summit WM User Guide*.

Figure 9: Summit WM Controller WM200/2000 front panel



WARNING!

MF1000, NP4000 and SC1100 maintenance is achieved by replacing the affected parts.
Properly shutdown the system prior to performing any maintenance on the system's main processing components, including the MF1000, NP4000, and SC1100 cards. For more information, see *"Powering off the Summit WM Controller WM200/2000" on page 90*.

Data ports cabling specification

The Summit WM Controller WM200/2000 data ports have copper connectors.

NOTE

If your infrastructure does not allow a copper connection, you must get a Gigabit Media Converter to convert the copper connection to a fibre optic connection. For example, you can use Netgear GC102 converter that receives the copper connection and outputs traffic via the fibre optic connector.

Summit WM Controller WM200/2000 power supply

The Summit WM Controller WM200/2000 is equipped with a redundant power supply (Figure 10). The redundant power supply provides the Summit WM Controller WM200/2000 with two power supplies. Having two power supplies provides administrators with the option of connecting a second power supply to an independent power source to ensure constant power availability in case of a power outage.

Figure 10: Summit WM Controller WM200/2000 power supply plugs and switches

The power supply LEDs (Figure 11) on the front panel of the Summit WM Controller WM200/2000 indicate if one or both power supplies are connected to a power source.

Figure 11: Power supply LEDs

If a power supply is connected and functioning, the **PWR GOOD** (amber) LED is lit. If a power supply is not connected, or if the power supply is connected but is experiencing problems, the **FAULT** (red) LED is lit.

Power FRUs

This section describes the power field replaceable units (FRUs) for the Summit WM Controller WM200/2000. It also provides procedures for removing, replacing, and verifying each FRU.

Summit WM Controller WM200/2000, AC-powered, redundant system

The power FRUs on an AC-powered redundant Summit WM Controller WM200/2000 system are two AC-to-DC shelf power supply units (ACPCI) on the Summit WM Controller WM200/2000 shelf.

Fan Tray

The fan tray (Figure 12) is a plug-in unit for 19-inch houses and consists of two 12-Vdc fans. It is suitable for on-site installation and replacement. An air current (from left to right) of 84 m3/h per fan is sufficient. Each fan generates a square wave, open collector signal that is proportional to the fan speed. The absence of this signal indicates a fan problem in the system. The fan tray is hot swappable. In order to replace the fan tray, the two screws on the fan tray cover must be removed.

WARNING!

Exercise caution when removing fan trays. It is recommended to wait until the fans stop rotating before removing the fan trays.

Figure 12 illustrates the fan model that is used: PAPST 3412 N/2.

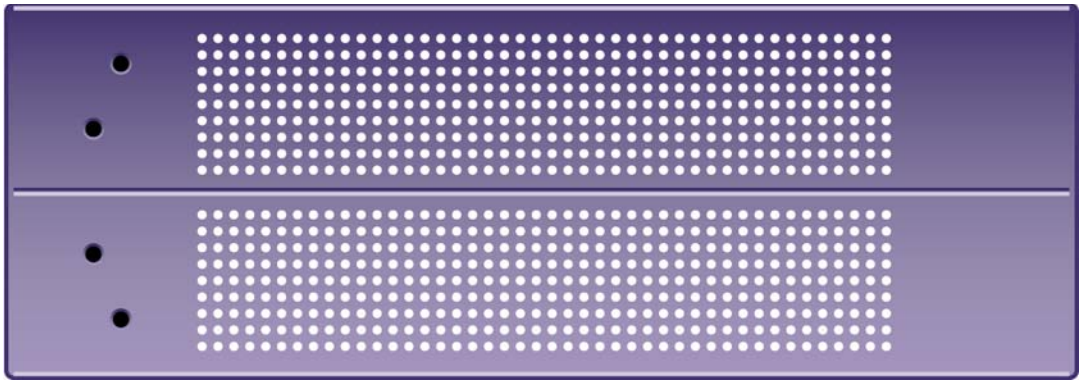
Figure 12: Fan Tray

The fan trays are positioned on the left and right in the Summit WM Controller WM200/2000 shelf. Each fan features three conductors (12 V, ground (GND), speed signal). The fan trays are connected to the backplane by a connection cable.

Figure 13 illustrates the fan tray covers, as well as the numbering of the fans. Figure 14 illustrates the ventilation grills for the Summit WM Controller WM200/2000 fans.

Figure 13: Fan tray covers and numbering of fans

Figure 14: Summit WM Controller WM200/2000 ventilation grills



MF1000 Media Flash Card

The MF1000 card (Figure 15) consists of a 1GB Flash Disk Drive. This card provides the persistent storage for the system. This card should not be unplugged during the live operation of the system. The system should be powered down prior to removal of the card to prevent any loss or corruption of persisted data.

Prior to powering down the system, the system's services should also be halted through the administration interface.

Figure 15: MF1000 card

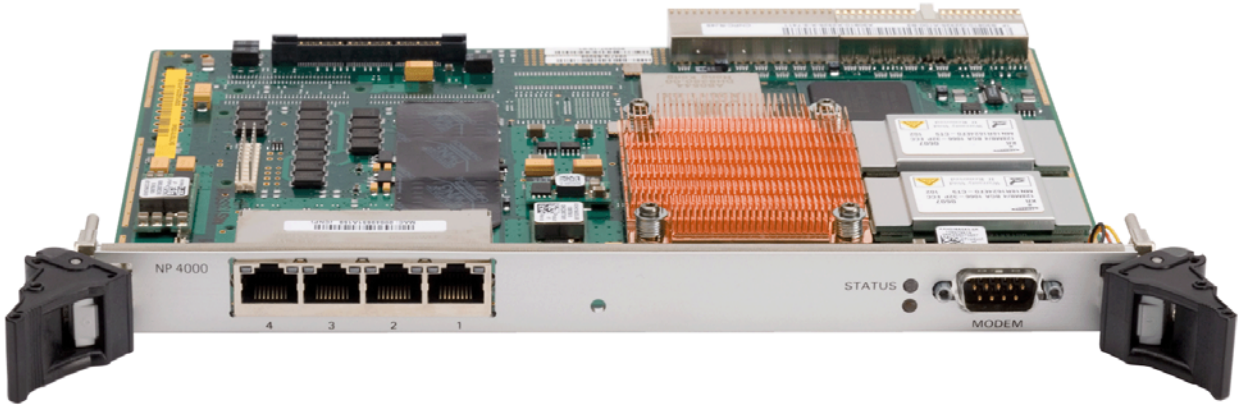
The MF1000 card includes:

- **Hardware Part Number** – MF1000 (including Flashdrive) S30810-K2319-X110
  - WM200/2000 Media Services Engine (MSE 2011)
- **LEDs** – The front side of the card features two green LEDs (IDE1 = HD/IDE2 = MO) that indicate the status of the individual drives.
- **Compact Flash** – A 1GB compact flash interface is also available on the card. The compact flash interface supports image management operations.

NP4000 Network Processor Card

The NP4000 card (Figure 16) is a full size (6U) Compact PCI (cPCI) form-factor card.

Figure 16: NP4000 card



The NP4000 card has the following main components:

- Pentium M processor
- Micron North Bridge with dual PCI bus
- 1GB DDR memory
- Dual stage Watchdog timer

- Two signal interfaces from redundant PSU that provide the following information to CPU (registered and memory mapped):
  - Provide alarm from PSU to s/w if redundant power module failed
- 2 MB of onboard Flash (used for system Bootrom, diagnostic, system serial number, Extreme Networks-specific MAC address for Eth ports, etc…; accessible by s/w applications).
- Management ports:
  - Main: 10/100BT LAN (RJ45) with Extreme Networks-specific MAC address, activity LED (bi-color) and speed LED (bi- color).
  - Console access port: RS-232 (DB9) serial interface
- CPU card will provide 7-segment LED display and 4 status LEDs (under s/w control) as a way to visually communicate with service personnel and end users
- One Reset button (external)

NOTE

Replacing the NP4000 blade will alter the MAC address of the management interface, which affects the product licensing system. As such, replacement of the NP4000 requires that the product key be transferred from the old NP4000 card to the new one. This transfer should be arranged through Extreme Networks technical support or sales support.

SC1100 Supervisory Card

The SC1100 card (Figure 17) is a full size (6U) hot swappable Compact PCI (cPCI) form-factor card.

Figure 17: SC1100 card

The SC1100 card has with the following main components:

- Network processor Unit
- 256MB of RDRAM
- 32MB of QDR SSRAM
- Non-transparent PCI bridge (Intel 21555) to provide 33/66MHz 32/64-bit PCI bus connectivity between NPU PCI interface and cPCI backplane
- 12-port SPI4.2 Gigabit Mac
- 4 x front-accessible Gigabit (data) ports

NOTE

Replacing the SC1100 alters the MAC addresses of the system data ports. New MAC addresses are advertised on the network in relation to the system interface IPs. You must ensure that no specific network topology is in place which can be affected by the MAC address change to the network. The IP addresses for the system do not change.

Summit WM Controller WM200/2000 power and maintenance procedures

This section provides procedures to power off and power on the system when performing maintenance. Use the following information to help eliminate system problems.

Tools and equipment required

Use the following tools and equipment to power on the system and verify system power:

- ESD kit
- Phillips screwdriver

Maintaining the ESD wrist strap

The ESD wrist strap and cord must operate properly to guard against ESD damage and electrical shocks. The wrist strap and cord assembly has a 1-megohm resistor; if the resistor fails, there is no ESD protection.

NOTE

Check the wrist strap weekly to ensure proper ESD protection.

To test the ESD wrist strap using a DMM:

1 Set the ohmmeter to 2-megohm resistance (see Figure 18).

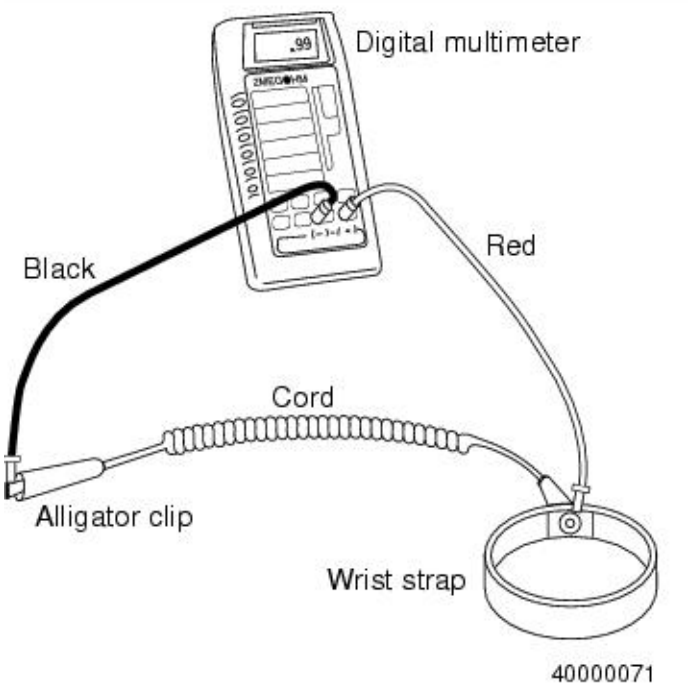
2 Connect the DMM black lead to the alligator clip at the end of the cord.

3 Contact the DMM red lead to the plate on the inner surface of the wrist strap.

4 Check the resistance reading on the meter. The meter reading must be between 0.80 and 1.20 mega ohms.

5 Replace the wrist strap and cord assembly if the reading is not within the allowable range.

Figure 18: ESD Wrist Strap and Cord Assembly



Using electrostatic discharge prevention procedures

Always follow the electrostatic discharge (ESD) prevention procedure when you remove and replace cards. Failure to follow the ESD prevention procedure can result in permanent or intermittent card failures.

CAUTION

Observe all precautions for electrostatic discharge.

WARNING!

To avoid electrical shock, never wear the ESD wrist strap while working on the power system or at the back of the cabinet.

To perform ESD prevention procedures:

1 Check the ESD wrist strap weekly to ensure proper ESD protection (refer to "Maintaining the ESD wrist strap" on page 87 and Figure 18).

2 Attach the ESD wrist strap to your bare wrist. Ensure that the inside of the strap makes good contact with your skin (see Figure 7-2).

3 Attach one end of the coiled wire to the wrist strap and the other end to the alligator clip, if necessary.

4 Connect the alligator clip to an unpainted portion of the cabinet frame. This safely channels electrostatic charges to ground.

5 Observe the following ESD prevention guidelines during the performance of system maintenance procedures:

- Handle cards by their edges only

CAUTION

Avoid contact between the card and your clothing. Electrostatic charges on clothing can damage the card. The wrist strap protects the card from electrostatic charges on your body only.

- Immediately place any card you remove from the system into a static-shielding package.

CAUTION

The card must remain in a static-shielding bag or static-free box until the card is returned to the warehouse.

- Do not remove a replacement card from its static-shielding packaging until you are ready to install it.

NOTE

This procedure applies to upgraded systems.

- Remove cards by pressing/pulling the cPCI card ears

NOTE

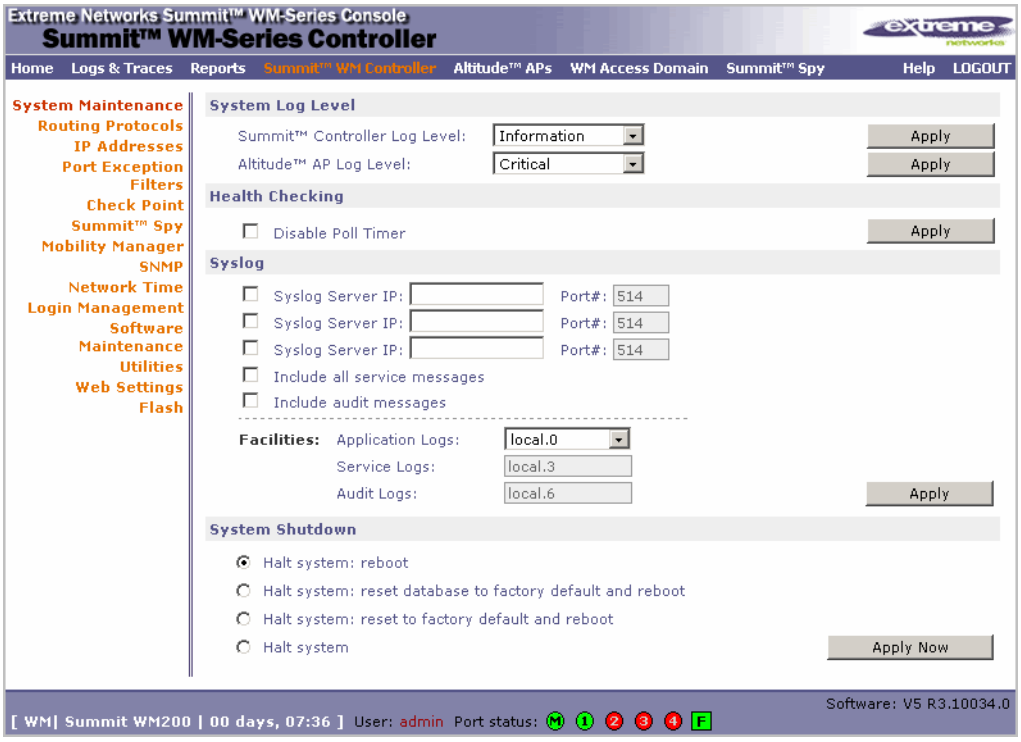
Cards are locked from manufacturing with a screw at each end. In order to remove a card, the holding screws must be remove.

Powering off the Summit WM Controller WM200/2000

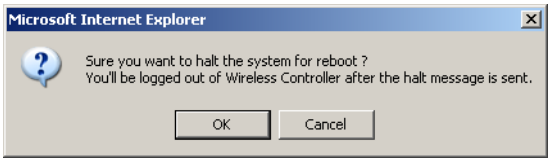
To power off the Summit WM Controller WM200/2000:

1 Login on the Summit WM GUI.

2 From the main menu, click **Summit Controller Configuration**. The **Summit Controller Configuration** page is displayed.



3 Under **System Shutdown**, select **Halt System**, and then click **Apply Now**. The following dialogue box is displayed.


Microsoft Internet Explorer
Sure you want to halt the system for reboot ?
You'll be logged out of Wireless Controller after the halt message is sent.
OK
Cancel

4 Click **OK**. The software's operations is halted and you are logged out of the system.

NOTE

An alternative method of stopping the software operation is to use the CLI commands. For more information, see the Summit WM CLI Reference Guide.

5 Switch off the Summit WM Controller's power switches, located on the back panel. The Summit WM Controller is now completely powered off.

Figure 19: Summit WM Controller WM200/2000 power switches

WARNING!

Do not power off the Summit WM Controller by using the power switches only. Instead, carry out the entire procedure as described above. Failure to do so may corrupt the data on the hard disk drive.

Backing up the Summit WM Controller WM200/2000 system configuration:

You can backup the Summit WM Controller WM200/2000 system configuration. You can also define the automatic schedule backups to occur. While defining a scheduled backup, you can configure to have the backup copied to an FTP server. The backup will be copied to the FTP server after the backup is completed on the local drive. For more information, see the *Summit WM User Guide*.

WARNING!

Whenever you change the system configuration, you must always define the automatic scheduled backup to be copied to the FTP server. Otherwise, you may not be able to retrieve the system configuration in the event of an MF1000 card failure.

Summit WM Controller WM20 maintenance

WARNING!

You should avoid operating the Summit WM Controller WM20 in a LAN in which the DC voltage is overlaid on the data lines because the LAN may have switches that connect directly without checking the supply voltage. Depending upon the transformer at the LAN interface, voltages of up to 500 Volts can be induced. Such peak voltages can destroy the physical LAN controller's logic.

The Summit WM Controller WM20 consists of the following components:

- Power Supply Unit
- Hard Disk Drive (HDD)
- MPE20 Card
- Fans

NOTE

The Summit WM Controller WM20 can operate with either 110 or 230 V AC.

No electrical connection exists between the Altitude APs and the Summit WM Controller WM20. The Summit WM Controller WM20 and the Altitude APs communicate with each other via the IP network. For more information, see the *Summit WM User Guide*.

Figure 20: Summit WM Controller WM20

NOTE

The USB Server Port is not used in the current release.

Summit WM Controller WM20 LEDs

The Summit WM Controller WM20 has four lights on its front panel. For more information, see "Summit WM Controller WM20 LEDs" on page 92.

Backing up the Summit WM Controller WM20 system configuration:

You can backup the Summit WM Controller's system configuration. You can also define the automatic schedule backups to occur. While defining a scheduled backup, you can configure to have the backup copied to an FTP server. The backup will be copied to the FTP server after the backup is completed on the local drive. For more information, see the *Summit WM User Guide*.

WARNING!

Whenever you change the system configuration, you must always define the automatic schedule backup to be copied to the FTP server. If this not done, you may not able to retrieve the system configuration in the event of HDD failure.

Summit WM Controller WM20 power and maintenance procedures

The power and maintenance procedures for the Summit WM Controller WM20 is similar to the Summit WM Controller WM200/2000. For more information, see "Powering off the Summit WM Controller WM200/2000" on page 90.

8 Altitude AP antenna selection

You can select the antennas to be used by each radio for the Wireless 802.11n AP model Altitude 450. The default antenna selection is to use all three antennas for each radio. This feature will enable the use of single band antennas.

NOTE

A radio must not be allowed to transmit into an antenna that is not designed for the operating band of the radio for the following reasons:

- *The antenna is not tested at those frequencies and therefore may produce results that exceed the regulatory limits.*
- *The antenna will have very poor efficiency and the power consumed by the corresponding amplifier will be simply wasted.*

When installing a single band antenna, the radio operating in the other band must be disabled so that it does not transmit into that antenna.

As the number of antennas that are used is reduced, the MIMO performance is also reduced. For instance, using 2 Tx/Rx antennas would reduce the separation between spatial streams but would still be compatible to two spatial streams, so that the 2 Tx/Rx antennas will obtain up to 130Mbps in a 20MHz channel or 300Mbps in a 40MHz channel.

When using 1 Tx/Rx antenna, multi-spatial streams are not possible; the Altitude AP will provide much lower throughput than when using 2 or 3 Tx/Rx antennas.

9 AP as 802.1X supplicant

802.1X is an IEEE standard which addresses the issue of how to provide network access to only authorized users. The basic idea behind 802.1X is that all network switches (authenticator) that perform 802.1X authentication will only allow 802.1X traffic when a connected device (supplicant) first connect to them. Only after they have been authenticated and authorized will their normal traffic be allowed to pass through. In the case of a wired Ethernet, the port through which an authenticated user connected will be enabled. Authorization in 802.1X is made possible through the use of Extensible Authentication Protocol (EAP) which allows supplicant requests to be forwarded to the authentication server (usually RADIUS server). The decision of whether or not to grant access is sent back to the Authenticator.

When configured as a 802.1X supplicant, the AP authenticates itself to the Authentication Server. This feature solves security issues in deployments where the attacker has physical access to the Ethernet connector on the AP, but does not have access to the Ethernet switch. For example, an AP placed in public spaces.

The 802.1X supplicant supports two EAP methods:

- EAP-TLS
- PEAP

EAP-TLS uses certificates for authentication and PEAP uses a username and password to verify server side certificates. The EAP protocol includes provision to negotiate the authentication method used by an authenticator and supplicant.

The 802.1X configuration is performed on a per AP basis. The GUI indicates which AP has 802.1X credentials, as well as which authentication methods are enabled on the AP.

There are two aspects to the 802.1X feature:

- Credential management – Includes requesting, creating, deleting, or invalidating the credentials used in the authentication process.
- Authentication – Involves the actual execution of EAP-TLS or PEAP protocol between the AP and the Authentication server. The Summit WM Controller plays no part in this process.

To implement the 802.1X supplicant with EAP-TLS, you need to have access to a Certification Authority (CA). The CA is used for EAP-TLS to generate the certificate.

Credential management

Administrators use the Summit WM Controller to manage the credentials on the AP. EAP-TLS credentials are the certificate and the private key. EAP-PEAP credentials are a username and password. The AP securely stores credentials and uses the correct credentials for the authentication type. The AP is not responsible for generating or requesting the credentials.

Use the Summit WM GUI to create and install the Credentials on the AP. You can install credentials on an AP individually or use the **AP 802.1X Multi-edit** page to do bulk credential installations.

The Summit WM GUI's **802.1X** tab provides AP credentials management:

1 Generate a certificate signing request (CSR) for a single AP. The generated CSR is stored on the local file system and needs to be retrieved for transfer to the CA. For the Common Name used in the CSR, you can use either the AP name, serial number, MAC address, or type a custom string.

2 Install a TLS certificate on the target AP. The certificate file is received from the third-party CA and is delivered from the Summit WM Controller to the AP as part of the AP configuration. When the Summit WM Controller is not used to generate the certificate signing request, the certificate file contains a private key which will be sent to the AP. The AP permanently stores the certificate in its local storage. For more information, see "TLS credential management" on page 99.

3 Install a PEAP username and password on the target AP. The username and password are delivered from the Summit WM Controller to the AP as part of the AP configuration.

4 Request one or more APs to delete PEAP or TLS credentials.

5 Retrieve credential information from the APs.

The Summit WM GUI's **AP 802.1X Multi-edit** page provides multi-AP credential management:

1 Generate certificate signing requests (CSRs) for a selection of APs. Generated CSRs are stored in a local tarred file and need to be retrieved for transfer to the CA. For the Common Name used in the CSRs, you can use either the AP name, serial number, or MAC address.

2 Install a TLS certificate and private key from a collection of certificate files. Certificate files should be stored in one zipped file. When the Summit WM Controller is not used to generate the certificate signing requests, the certificate file contains a private key which will be sent to the AP. APs are matched based on AP name, serial number, or MAC address.

3 Install PEAP a username and password to a selection of APs.

The Summit WM GUI leverages the information it has on registered APs to simplify the certificate request process. Specifically, the Summit WM Controller will remember the organization, country, organizational unit, and other credentials likely required on all certificates between subsequent certificate requests. It will also provide a means to enter the common name from a list. The list will include:

- MAC address of the AP (displayed on the APs packaging)
- AP serial number
- AP name
- Other

If you select **Other**, type any text string that will be used as the common name.

Transferring credentials from the Summit WM Controller to AP

The PEAP username, PEAP password, and TLS private key are installed on the AP using a configuration message. The AP retrieves the certificate from the TFTP provided by the Summit WM Controller (IP address and the path to the Certificate). The TLS private key, PEAP username, and PEAP password are transferred encrypted using the blowfish algorithm. Certificates, by their very nature, are public documents so will not be encrypted during transmission.

The AP performs validation on a received TLS certificate and private key before installing it in the persistent storage. The AP fails the verification if the certificate is expired, if the certificate does not match the private key, or if the certificate has an invalid X509 format. In such a case, the AP retains the existing certificate and private key if one exists. The AP does not perform any verification for the PEAP username and password.

Storing credentials on the AP

Credentials are stored on the AP in persistent storage. The private key is encrypted (i.e. scrambled) using a 256-bit key called AP storage key (APSK). Resetting the AP to factory defaults destroys the private keys and the certificates.

The Summit WM Controller stores the AP's private key and certificate for as long as is required to transfer it to the AP. Once the AP acknowledges the successful receipt of a valid key and certificate, the Summit WM Controller destroys its copies.

TLS credential management

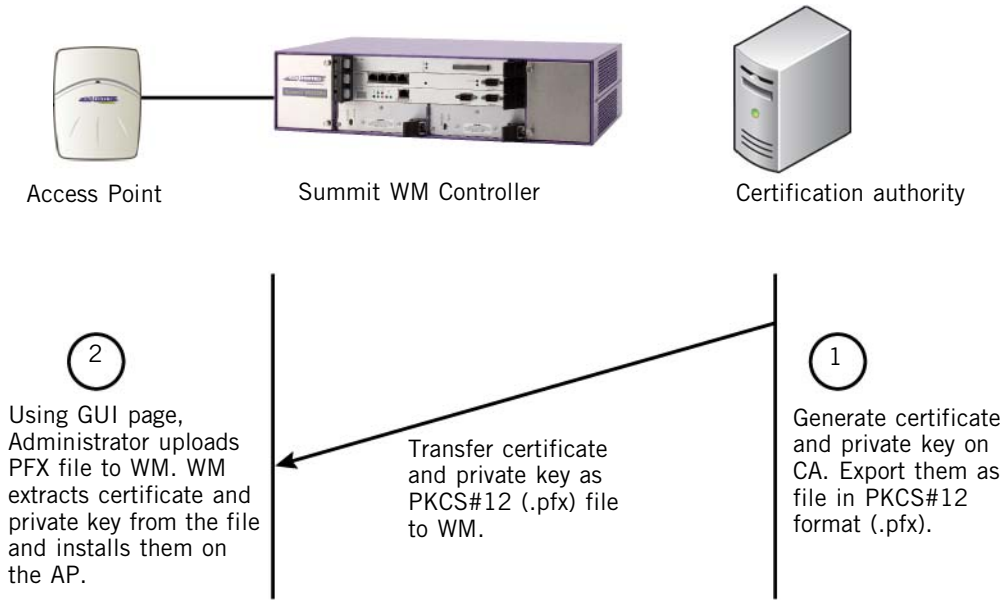
When configuring an AP with EAP-TLS, the Summit WM Controller can operate in two modes:

- Pass-through
- Proxy

Pass-through

In pass-through mode, the Summit WM Controller simply installs certificates and private keys on the APs. The Summit WM Controller does not issue certificate signing requests on behalf of the APs and does not serve any PKI functions. All PKI functionality, including maintaining backups of certificates is the responsibility of the administrator, who uses a PKI tool set external to the controller for this purpose. In this case, TLS certificate and private keys must be delivered to the Summit WM Controller in Personal Information Exchange - PKCS#12 (.PFX) format.

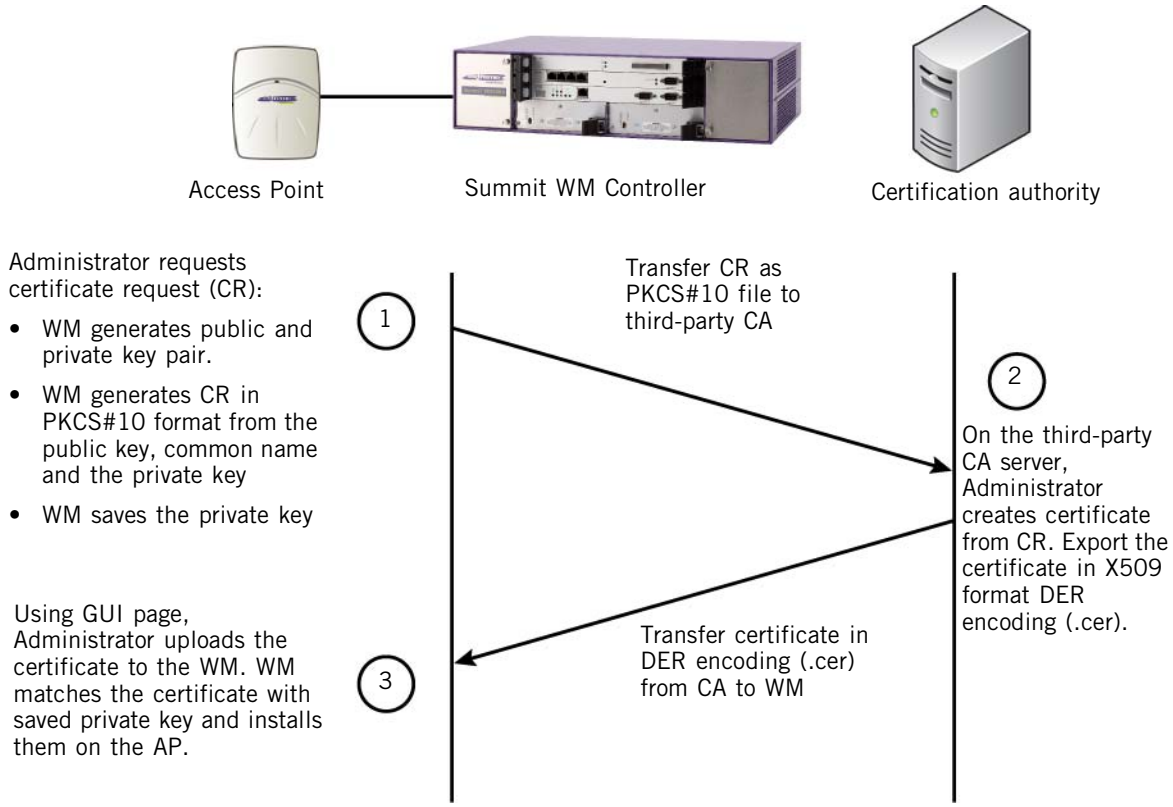
Figure 21: Pass-through mode


Access Point
Summit WM Controller
Certification authority
2
Using GUI page, Administrator uploads PFX file to WM. WM extracts certificate and private key from the file and installs them on the AP.
Transfer certificate and private key as PKCS#12 (.pfx) file to WM.
1
Generate certificate and private key on CA. Export them as file in PKCS#12 format (.pfx).

Proxy

In proxy mode, the Summit WM Controller generates a CSR in PKCS#10 format for APs at the request of the administrator and generates a private key for the AP. The Summit WM Controller installs the certificate and private key to the AP once the CA has generated a signed certificate in DER encoding (.CER). In this mode, the administrator is responsible for uploading the AP's certificate to the AP using the Summit WM GUI. The Summit WM Controller installs the pair of certificate + private key to the AP. Figure 22 below illustrates the process of installing TLS certificates using proxy mode.

Figure 22: Proxy mode


Access Point
Summit WM Controller
Certification authority
Administrator requests certificate request (CR):
• WM generates public and private key pair.
• WM generates CR in PKCS#10 format from the public key, common name and the private key
• WM saves the private key
1
Transfer CR as PKCS#10 file to third-party CA
2
On the third-party CA server, Administrator creates certificate from CR. Export the certificate in X509 format DER encoding (.cer).
Transfer certificate in DER encoding (.cer) from CA to WM
3
Using GUI page, Administrator uploads the certificate to the WM. WM matches the certificate with saved private key and installs them on the AP.

TLS certificate expiration

Certificates have an expiration date assigned by the CA. Once a certificate expires, the AP cannot authenticate to the Access Server and the AP is inaccessible as long as the authenticator (AU) port is configured to perform 802.1X authentication. The AP performs checks on the installed certificate, detects that a certificate is 30 days from expiring, and generates an AP log alarm which is forwarded to the Summit WM Controller.

Alarms are continually generated as long as the certificate is not upgraded. The interval between logs is halved each time. For example, 15 days after the 30 day alarm the AP generates a 15 day warning. After that, the next warning is generated when 7 days are left, and so on. At most, one log per day is generated and any pending log is cancelled if the certificate is replaced.

TLS server authentication

As part of the EAP-TLS, a client may use server authentication. AP 802.1X supplicant will not authenticate the authentication server. Consequently, it does not need to be configured with the address of a certificate repository, a collection of CA certificates, or a CRL during .1X authentication.

Authentication with 802.1X

In order to enable 802.1X authentication, the authenticator (AU) must be configured for 802.1X on the port where the AP is connected. The access switch also needs to know the IP address (likely secret) of the authentication server (AS). The AP performs authentication directly with the authentication server through the authenticator. The Summit WM Controller does not participate in the authentication process and is unaware of the AU or AS.

During the authentication, the AP continues sending non-802.1X traffic (discovery packets) on the Ethernet port. In other words, if the network infrastructure requires 802.1X authentication the AP will authenticate, but otherwise, it will not force authentication if the infrastructure does not require it.

802.1X authentication is usually triggered by the AU when the Ethernet link state changes or when the AP is rebooted. On startup, the AP sends an EAP start message and waits for an EAP identity request from the AS. If no identity request is received, the AP assumes that there is no 802.1X and enters into authenticated state. If an identity request is received at a time later, the AP restarts the authentication. If the authentication fails, the AP constantly retries the authentication from the beginning (sending EAP start message).

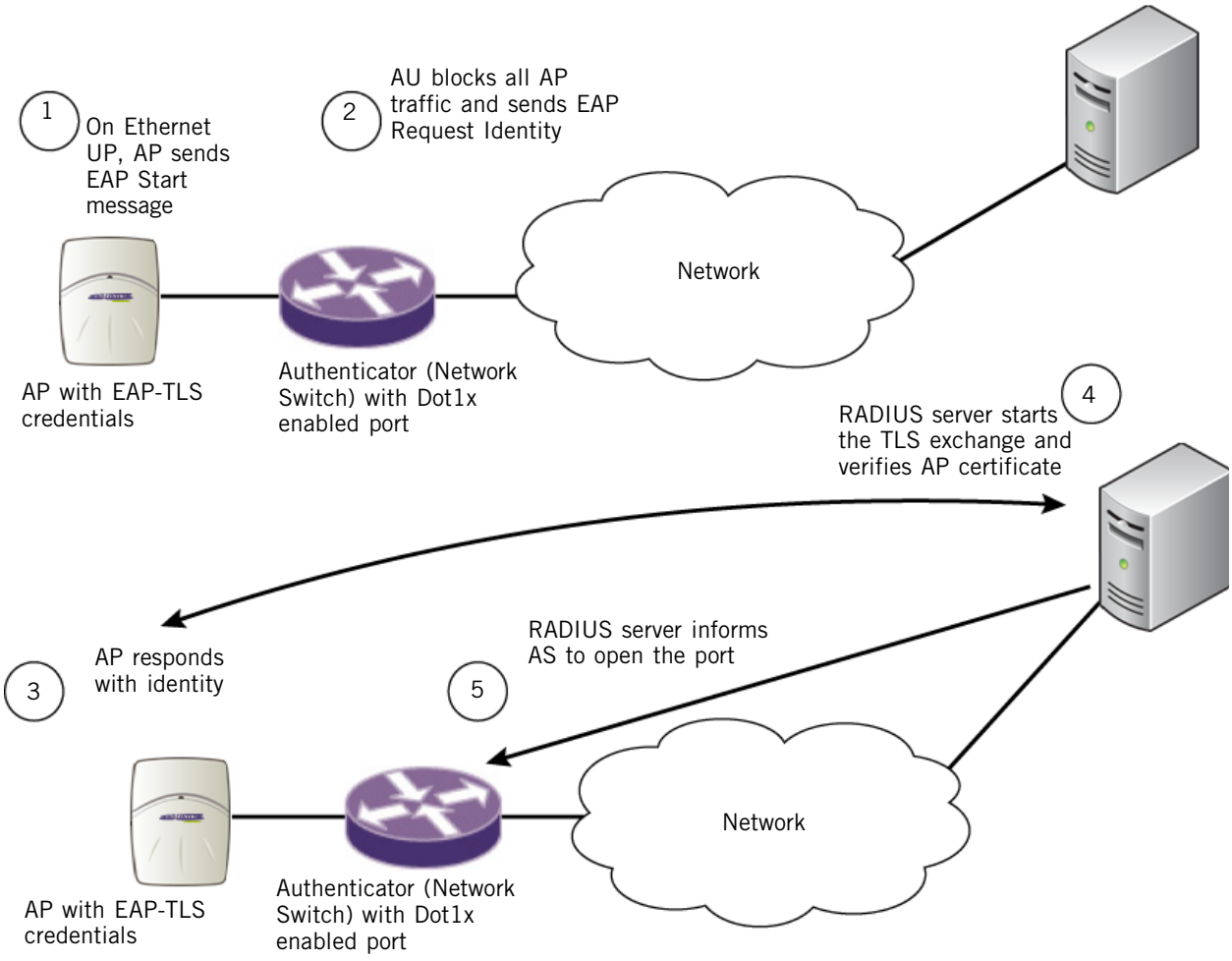
The AP cannot connect to the Summit WM Controller or respond to telnet before the AU opens the ports. Before deploying an AP in the 802.1X enabled network, the AP must be configured with the correct credentials. Otherwise, if the credentials are wrong or the AP is not configured for 802.1X, the AS blocks all traffic and the AP will be inaccessible for the Summit WM Controller or telnet. In such a case, either the AP should be connected to another non-802.1X port or the 802.1X can be turned off on the access switch for that port until the AP is connected to the Summit WM Controller and proper authentication credentials are installed.

During the 802.1X authentication process, the AP LEDs signal the progress of the 802.1X authentication and logs the events using Log Alarms. Log Alarms are available on the Summit WM Controller once the AP connects to the Summit WM Controller.

EAP-TLS authentication

Figure 23 below illustrates the EAP-TLS authentication process. The AP is directly connected to the access port on the authenticator. The AP begins the process by sending an EAP start message to the AU and responds to the AU identity request. The AP provides the identity in the identity reply. Identity is presented to the AS and from that moment on, EAP-TLS messages are exchanged between the AS and the AP.

Figure 23: EAP-TLS authentication


1
On Ethernet UP, AP sends EAP Start message
2
AU blocks all AP traffic and sends EAP Request Identity
Network
AP with EAP-TLS credentials
Authenticator (Network Switch) with Dot1x enabled port
4
RADIUS server starts the TLS exchange and verifies AP certificate
3
AP responds with identity
5
RADIUS server informs AS to open the port
Network
AP with EAP-TLS credentials
Authenticator (Network Switch) with Dot1x enabled port

The end result of the EAP-TLS authentication is verification of the AP certificate by the AS server. If successfully verified, the AU is informed with the EAP success message and the AU opens the port for all traffic. Otherwise, the AU maintains the port closed, and no other traffic besides .1X EAP messages are permitted.

In the case of authentication failure, the AP begins the process from the beginning by sending an EAP start message. If for any reason the AP cannot successfully complete the authentication, it will remain in this cycle. Status of the EAP-TLS authentication is displayed on the AP LEDs.

EAP-PEAP authentication

EAP-PEAP involves the same three security elements as the EAP-TLS:

- Supplicant (AP)
- Authenticator
- Authentication server

EAP-PEAP consist of two stages:

- Establishment of the TLS tunnel in order to prepare a secure channel for the second stage
- Authentication based on the challenge response authentication methods

APs support MD5 and MS-CHAPv2 authentication protocols.

Configuring APs for .1X authentication

General configuration

In most cases, APs are deployed in already .1X enabled networks with existing RADIUS servers. In such cases, APs need to be preconfigured with the proper credentials and authentication methods before deployment to the access ports. APs are preconfigured by connecting them directly to the Summit WM Controller and installing the credentials. If network switch and procedures allow, APs can be configured directly on the access ports with .1X temporary disabled. After installing the credentials, .1X is enabled on the port.

Configuring APs for .1X supplicant involves installing the proper credentials on the AP and/or generating the Certificate Signing Request (CSR) for EAP-TLS. After the AP is configured with credentials and deployed in the network no additional configuration is required. The AP detects the request for authentication from the AU and using the EAP protocol, negotiates the authentication method. To avoid prolonged authentication due to mismatched authentication protocols on the AS and AP, a recommended practice is to configure the AS with the same authentication protocol as the AP.

After credentials are accepted by the AP, the light bulb icon next to the authentication method with installed credentials (EAP-TLS or EAP-PEAP) is lit on the **802.1X** tab. The light bulb icon is lit even if the AP does not participate in .1X authentication, as long as there are valid credentials installed on the AP.

Use the Summit WM GUI's **802.1X** tab to configure individual APs. The Summit WM GUI's **802.1X** tab is available only for AP models that support .1X supplicant feature.

Use the **AP 802.1X Multi-edit** page to configure multiple APs. The **AP 802.1X Multi-edit** page only lists APs that support .1X supplicant feature.

EAP-PEAP configuration

Do the following:

1 Select the AP that you want to configure from the Wireless APs page.

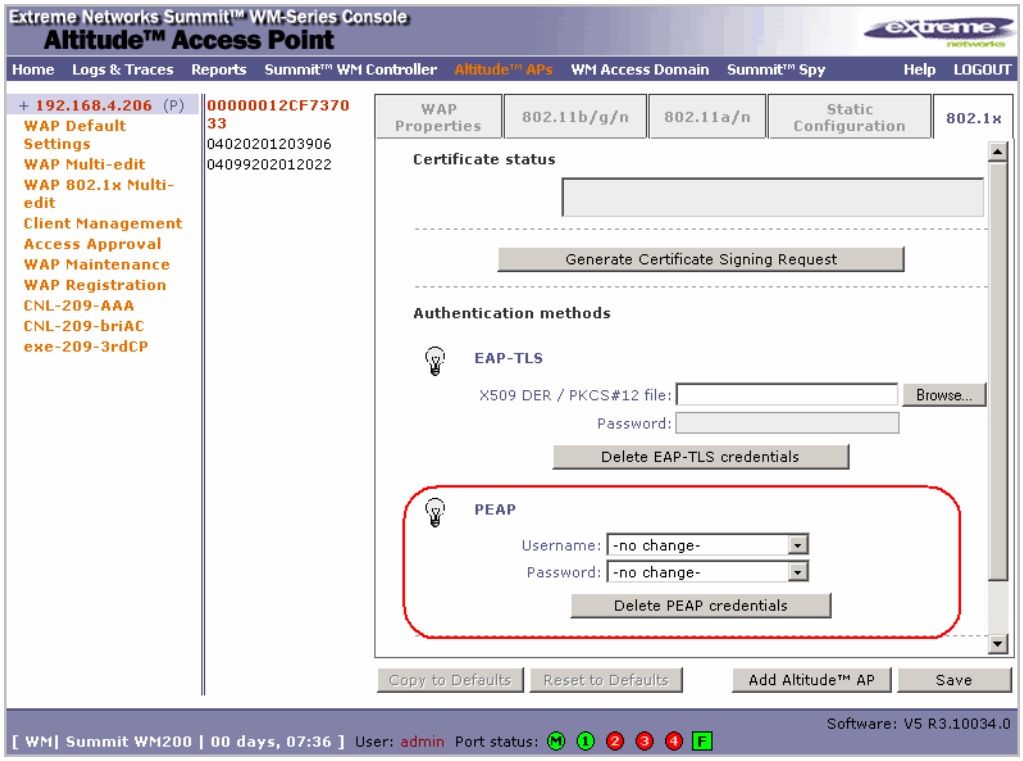
2 Click the **802.1X** tab.

3 Type the EAP-PEAP username and password. The username can be one of the pre-defined choices: AP name, serial number, MAC or type a custom string.

4 Save the configuration. The certificate status window displays the results of the configuration push to the AP.

NOTE

The AP should be connected to the Summit WM Controller in order to receive and acknowledge the configuration. If the AP is not connected, the configuration will be pushed the next time it connects to the Summit WM Controller.



Configure AP with EAP-PEAP credentials

EAP-TLS configuration with the Summit WM Controller as proxy

EAP-TLS authentication, unlike EAP-PEAP, involves a third-party CA server to generate the credentials. Do the following:

1 In proxy mode, click **Generate Certificate Signing Request** on the **802.1X** tab to create the certificate request.

2 Fill up the entries and save the CSR in PKCS#10 format on the local machine disk. The Summit WM Controller names the file with the AP serial number and .csr extension.

3 After obtaining the certificate from the CA, navigate to the .cer file under the EAP-TLS section of the **802.1X** tab. Confirm that the file was exported in DER format (.cer). Do not specify a password since it is only necessary when the file format is .pfx and contains the private key.

4 To easily match .cer files to an AP, export the certificates from the CA to a file with AP serial name.

5 Save the configuration. The certificate status window displays the results of the configuration push to the AP. The AP may reject the configuration for one of the reasons described in "Transferring credentials from the Summit WM Controller to AP" on page 98.

NOTE

In proxy mode there is a possibility of a mismatch between the private key created with the CSR and the certificate returned from the CA. The Summit WM Controller retains the private key that was created together with the CSR. If a new CSR is created by clicking ***Generate Certificate Signing Request*** *before the certificate is returned from the CA, a new certificate is required because the old private key is overwritten with the new key.*

EAP-TLS configuration with the Summit WM Controller as pass-through

In pass-through mode, the certificate and the private key are generated on the CA and exported as PKCS#12 (.pfx) file. Do the following:

1. On the **802.1X** tab, navigate to the .pfx file under the EAP-TLS section. Confirm that file was exported in PFX format.
2. Type the password (since most of the .pfx files are password protected).
3. To easily match .pfx files to an AP on the Summit WM Controller, export the certificates and private key from the CA to a file with AP serial name.
4. Save the configuration. The certificate status window displays the results of the configuration push to the AP. The AP may reject the configuration for one of the reasons described in "Transferring credentials from the Summit WM Controller to AP" on page 98.

Bulk EAP-TLS configuration

Bulk Configuration provides configuration of multiple APs simultaneously. When creating a bulk CSR, the Summit WM Controller creates a collection of .csr files (one for each AP) packed in a .tar file. Each .csr file is named according to the corresponding AP serial number. The distinguished name information (country, location, etc) used in the CSR are the same for all APs selected — only the common name is unique. The common name can be AP MAC address, AP name, or serial number.

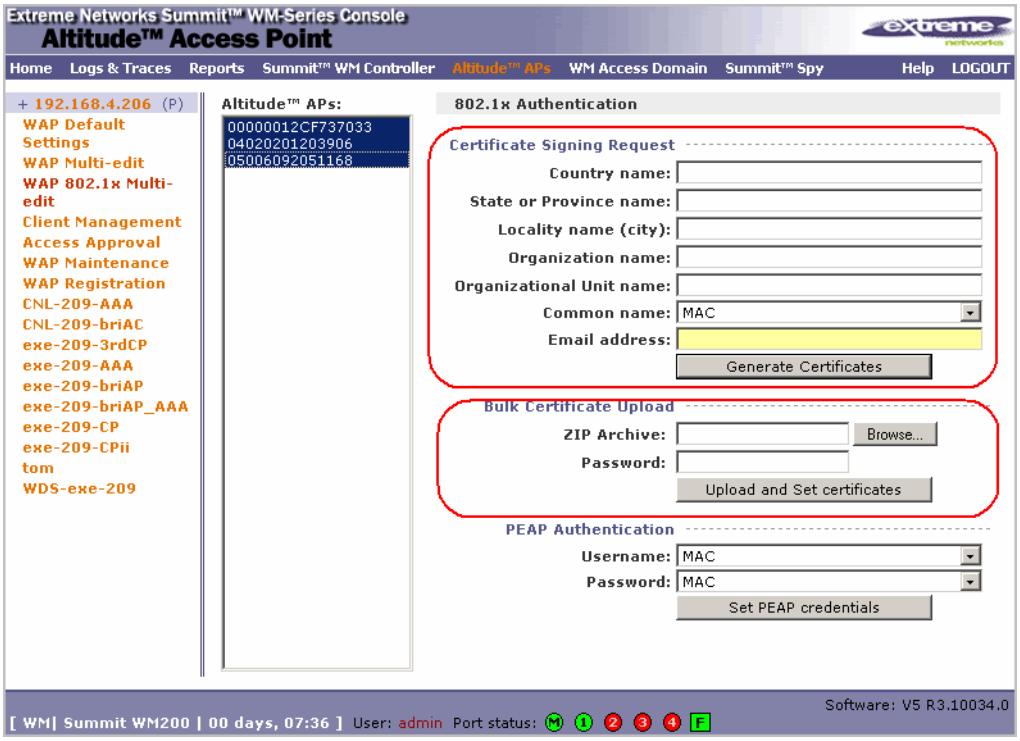
To install certificates in proxy mode, the following occurs:

- Exported .cer files from the CA are packed in a zip file and loaded on the Summit WM Controller.
- When uploading the .zip file, APs are required to be selected.
- The Summit WM Controller matches the .cer files from the zip with the AP, based on the serial number. If a .cer file name does not match any AP serial number, the Summit WM Controller looks into the certificate and uses the common name to match the AP.
- Save the configuration. The certificate status window displays the results of the configuration push to the AP. The AP may reject the configuration for one of the reasons described in "Transferring credentials from the Summit WM Controller to AP" on page 98.

To install certificates and private key in pass-through mode, the following occurs:

- Exported .pfx files from the CA are packed in a zip file and loaded on the Summit WM Controller.
- When uploading the .zip file, APs are required to be selected.
- The Summit WM Controller matches the .pfx files from the zip with the AP, based on the serial number. If a .pfx file name does not match any AP serial number, the Summit WM Controller looks into the certificate and uses the common name to match the AP.
- The password for all .pfx files should be identical.

- Save the configuration. The certificate status window displays the results of the configuration push to the AP. The AP may reject the configuration for one of the reasons described in "Transferring credentials from the Summit WM Controller to AP" on page 98.



Create CRs for selected APs

Upload .zip file with EAP-TLS credentials

Bulk EAP-PEAP configuration

To install EAP-PEAP username and password, do the following:

1 From the **AP 802.1X Multi-edit** page, select the APs from the list.

2 Type a password. The username can be the MAC address, AP name, or the serial number. The password can be the MAC address, AP name, or the serial number.

3 Save the configuration. The certificate status window displays the results of the configuration push to the AP. The AP does not reject the EAP-PEAP configuration.

Verifying the AP .1X configuration

After configuring the AP, the status of the .1X supplicant configuration and authentication process can be confirmed by doing the following:

- Refer to the **802.1X** tab. Display the details of the installed credentials on a particular AP. This displays most of the fields in the X509 Certificate currently installed on the AP and/or the PEAP credentials. Information on the credentials is directly retrieved from the AP.
- Refer to the **802.1X** tab. The light bulb icon next to the authentication label is lit if there are valid credentials installed. If credentials are deleted, the light bulb is turned off.
- Refer to the **AP Inventory** report. This report displays a summary of .1X supplicant configuration for multiple APs. The TLS section for each AP displays the expiration day of the certificate if a certificate

is installed, and the PEAP section displays **enabled** if the PEAP username and password are configured.

- Refer to the AP logs. The AP logs major events during the authentication process.

Limits and technical data

Credential limits (TLS and PEAP):

- Distinguish name limits in the certificate (based on rfc3280)
  - ub-country-name-alpha-length INTEGER ::= 2
  - ub-locality-name INTEGER ::= 128
  - ub-state-name INTEGER ::= 128
  - ub-organization-name INTEGER ::= 64
  - ub-organizational-unit-name INTEGER ::= 64
  - ub-emailaddress-length INTEGER ::= 128
  - ub-common-name-length INTEGER ::= 64
- The certificates info subject and issuer max length is 640 bytes
- Alternative name max length is 320 bytes
- PEAP username is max of 128 characters
- PEAP password is max length of 128 characters

Crypto suite announced for authentication

Max length for RSA keys (private and public) is 4096 bits (upper bound modulus).

These are a crypto suite used by AP for .1X supplicant:

- RSA with AES 128 CBC SHA
- RSA with RC4 128 MD5
- RSA with RC4 128 SHA

Table 25: Encryption

Symmetric encryption	Crypto Alg	Key Length	Mode	Implemented
RSA_AES_128_CBC_SHA	AES	128 bits	CBC	Yes
RSA_RC4_128_SHA RSA_RC4_128_MD5	RC4	128 bits		Yes
Asymmetric encryption				Yes
RSA_AES_128_CBC_SHA RSA_RC4_128_MD5 RSA_RC4_128_SHA	RSA	Max 4096 bits		Yes
Encryption Protocols				

Table 25: Encryption (Continued)

Symmetric encryption	Crypto Alg	Key Length	Mode	Implemented
• EAP-TLS, EAP-PEAP, • PKCS#1, PKCS#7, PKCS#12, PKCS#10, • RFC-2246, TLS Protocol Version 1.0 • RFC-3268, AES Ciphersuites for Transport Layer Security • RFC-3280, Internet X.509 Public Key Infrastructure • RFC-3546, Transport Layer Security Extensions (partially supported) • RFC-4279, Pre-Shared Key Ciphersuites for Transport Layer Security				

10 MAC-Based Authentication

The MAC-based authentication feature is designed to further control access to the network resources for the wireless clients over the Summit WM system. It is based on the authentication of the client's MAC address using the same process as for the user's RADIUS authentication.

Only authenticated clients – MAC addresses can establish sessions and use network resources as defined by the rules for the virtual network segment. Depending on the assignment of the virtual segment (NONE, SSID and AAA), the user's authentication may be required. The MAC based authentication, in that sense, is more a form of authentication – giving permission to the wireless clients to enter the system. If the RADIUS server rejects the authentication, the Summit WM Controller will send the message to the Wireless AP and the Wireless AP will disconnect the client.

The feature is configurable per WM-AD via GUI as a part of the radius profile definition. It includes the radius redundancy with up to three radius servers.

It is also designed to work in cases of clients roaming and mobility. A wireless client can be forced to start the MAC-based authentication when roaming from one Wireless AP to another in the roaming and mobility cases.

How MAC-based authentication works

1. When a client attempts to associate with a WM-AD which has MAC-based authentication enabled, the Wireless AP triggers the association request, which will be forwarded through the control plane to the Security Manager, then to the Radius Client. The Radius Client will send the access request to the RADIUS server, containing the MAC address of the wireless client for the userId and password.

   By default, the Summit WM Controller uses the MAC address of the device as both the userID and password for the authentication. However, if a value is typed into the **Password** field by an administrator, the typed password will be used in place of the MAC address during the authentication request to the server. For example, userID = MAC, password = administrator provided password. This feature operates as an overwrite, which allows the administrator to more easily define radius policies for MAC-based authentication.
2. When Authentication Request is received, the Authentication Server validates the request (if it is coming from the known client – Summit WM Controller) and then decrypts the data packet to access the user name and password information, in this case the MAC address. This information is passed to the appropriate security system, which verifies the existence of the user and the correctness of the password, as well as the authentication type (PAP, CHAP, MS CHAP). Depending on the server, it can be a UNIX file, Active directory, etc.
3. If an account for the MAC address is defined on the RADIUS server, and it passes the security check, the RADIUS server will send the access accept to the Summit WM Controller, and the FE will create an MU session.
4. If the MAC address failed the security check, the RADIUS server will send the access reject to the Summit WM Controller. Upon receiving the access reject, the Summit WM Controller will send a message to the Wireless AP and the Wireless AP will disconnect the client.

Roaming

When a client roams from one Wireless AP to another, the MAC authentication is not required by default. The MAC authentication can be forced in the roaming case. It could happen that the user re-authentication is not required, but that the MAC re-authentication is.

Radius redundancy

If the primary server for the MAC authentication is not accessible, the radius redundancy will be triggered and the request will be sent to the next server. The expected behavior is similar to the description in the RADIUS redundancy documents.

Rejection and failure

There is a difference in handling rejection and failure.

Rejection is when the MAC address is rejected by the RADIUS servers.

Initially, the Radius server timeout was treated as rejection (MU_NOT_ALLOWED), but it has been changed. If the vnMgr does not receive a reply within the specified time, it will not send rejection to the MU Session Manager. Instead, it will send different message indicating authentication failure (MU_AUTH_ERROR). The same occurs for the timeout from the other components in the chain:

- Radius client timeout
- Security manager timeout
- VnManager timeout

In order to avoid processing continuous request of unauthorized clients, the feature includes instant rejection by Wireless AP for defined duration, after which the record will be completely deleted and new authentication process may proceed. The rejected clients will not be in the black list, since the black list applies to all WM-ADs, while the restriction for a MAC-based authentication is WM-AD based.

For the MU association, if the MU Session Manager does not get a reply from the vnMgr within the 30 sec, it will send the failure to Wireless AP. Since the vnMgr can get another request from the same client, it will have different ID and the first reply will be dropped.

Additional RADIUS attributes

The access_accept may include the session timeout, which will be applied to the pre-authenticated session timer. It also may include the re-direction URL, which should be included in the filter definitions for the WM-AD.

Assumptions/recommendations

1. The MU session timeout is a very important factor in radius profiles definitions and timeouts. The session timeouts can be configured via the Summit WM GUI.
2. In order to avoid an infinitive loop, the radius redundancy should happen within 30 seconds, otherwise the authentication requests will be sent to the non-responsive server.
3. MAC-based authentication is not available for the 3rd Party AP WM-AD
4. Wireless AP keeps records of rejected MAC addresses in the SIB table (Station Information Base), with the special status "cleared". The capacity of the table is 128 records. It is possible for the limit to be reached, for example when a number of unknown clients (MAC addresses) attempts to authenticate. In that case a perfectly valid client can not associate, until a record in the SIB table is timed out (2-3 min).

Use Cases

The MAC-based authentication could be used in different ways, as described in the MRD and design document. It can be implemented as:

1. Corporate authentication mechanism.
2. Addition to the existing authentication mechanism in a form of the device (MAC) authentication.

In both cases the feature gives the network administrators an option to increase security by allowing association with a WM-AD to authorized devices only. It will require RADIUS server with accounts based on the MAC address for each device, which will be authorized to access a WM-AD, and update for all new devices. The second level of authentication requires users' accounts for CP or 802.1X, which are independent from the MAC accounts.

The MAC based authentication can be used for any type of the WM-AD assignment (3rd Party AP Excluded).

In the environment with multiple RADIUS servers, a server may be dedicated to the device authentication, while the other server may be used for the users' authentication, or one server can be used for both levels. The system will allow redundancy on both levels.

Vendor Interoperability

MAC-based authentication has been tested with the following platforms:

- Newbury Locale Server
- IAS
- FreeRADIUS
- Funk Steel Belted RADIUS & Odyssesy

11 FreeRADIUS and Security

Overview

A good way to get up a running with an inexpensive RADIUS server is to use FreeRADIUS. This program is available from www.freeradius.org and provides good options for RADIUS authentication and accounting. While it is possible to configure FreeRADIUS to interoperate with a Microsoft infrastructure such as Active Directory using LDAP it is recommended that IAS (Internet Authentication Service) is used for better integration with a Microsoft environment.

For those without a Microsoft infrastructure, read on.

FreeRADIUS is available as a tarball from the FreeRADIUS website and it can be readied for use on most systems with the typical steps:

```
./configure
make
make install
```

The current release of FreeRADIUS is 2.0.1. Once it is installed the configuration files are typically found at either /usr/local/etc/raddb or under /etc/raddb. The binary is called radiusd and running the file in the foreground as radiusd -X is *very* useful for debugging RADIUS requests.

Configuration

The configuration of FreeRADIUS involves modifying several files that usually reside under /usr/local/etc/raddb or /etc/raddb.

radiusd.conf file

The main configuration for FreeRADIUS is within the radiusd.conf file. This file contains general options for how the server behaves, which general protocols to respond to, etc. Here are some notes on the sections that may come in handy:

authorize section

Uncomment all auth types that are in use (files is the name of the type that uses the user file).

clients.conf file

This file contains definitions of RADIUS clients that are allowed to interact with the RADIUS server for AAA information.

The simplest format to use is:

```
client 10.0.0.10 {
secret = testing123
shortname = WLC001
}
```

In this case the RADIUS client is a Summit WM Controller at 10.0.0.10. Since the Summit WM Controller has many IP addresses, some physical and some virtual, there is confusion over which IP address to use as the RADIUS client address. The answer is that whatever interface the Summit WM Controller will use to send the packet to the RADIUS server. In the CLI of the Summit WM Controller use the ping <target> command to determine which interface will be used if it is not obvious. If the path to the RADIUS server changes based upon OSPF routing updates then it is best to enter all possibilities into this file.

The secret parameter will be asked for during the configuration of the Summit WLAN equipment and is typically referred to as the 'shared secret'.

users file

Example for Captive Portal Authentication

The users file is used for entering static information that can be used for authentication. The simplest form of an entry is:

```
"username"  Auth-Type := local, User-Password == "aDRM123"
```

This type of entry can be used for CHAP authentication types. This entry can also be used for PAP-type authentication types provided that the pap definition in the modules section of the radiusd.conf file has the encryption_scheme set to 'clear' rather than the default of 'crypt'.

Attributes can be added to the user definition in this file. An example for a captive portal environment would be:

```
"username"  Auth-Type := local, User-Password == "aDRM123"
Filter-Id = "filter1",
Session-Timeout = 10
```

In this example the filter-id 'filter1' is returned to the Summit WM Controller and a session timeout of 10 minutes is returned. If the Summit WM Controller has a filter defined that matches the returned Filter-Id attribute then it will be used. In addition, if the session is successfully authenticated then the session on the Summit WM Controller has an absolute limit of 10 minutes at which point re-authentication will be necessary.

Example for MAC-based Authentication

Users can also be defined directly as type PAP, for example, for MAC-based authentication the Summit WM Controller sends both the username and the password as the MAC address by default, so it is typical to see a device entered into the users file as follows:

```
#vocera badge example
"0009EF003BAF" Auth-Type := PAP, User-Password == "0009EF003BAF"
```

The only difference with overwrite is that the password does not have to be the MAC address of the device, but rather it can be anything the administrator configures (and matches on the Summit WM Controller).

To use the Challenge Handshake Access Protocol (CHAP) which prevents the password from ever being transmitted between the Summit WM Controller and the RADIUS server switch the Auth-Type setting to CHAP and change the Auth. Type in the WM-AD settings under the Auth & Acct tab to use CHAP.

```
#vocera badge example
"0009EF003BAF" Auth-Type := CHAP, User-Password == "0009EF003BAF"
```

You may also switch to MS-CHAP or MS-CHAPv2 in the Summit WM Controller and then format the user entry as follows:

```
#vocera badge example
"0009EF003BAF" Auth-Type := MS-CHAP, User-Password == "0009EF003BAF"
```

This type of entry supports both MS-CHAP and MS-CHAPv2 authentication types from the Summit WM Controller.

Note that RADIUS attributes cannot be returned for MAC-based authentication.

Example for 802.1X Authentication

To define a user for PEAP or TTLS authentication where a username/password combination is still required the user can be formatted as:

```
"username"  Auth-Type := EAP, User-Password == "aDRM123"
```

However, this will make this user ONLY useful for EAP connections. Otherwise format the user as Auth-Type ‘local’ and FreeRADIUS will use the user entry for PAP, CHAP, and EAP auth-type messages.

eap.conf file

For recent versions of FreeRADIUS the configuration of EAP has been moved from the radiusd.conf file into a separate file called eap.conf. If you don’t have this file look for these configuration items within the radiusd.conf file itself.

The configuration of EAP support under FreeRADIUS involves the following steps:

1 Generate / Install Certificates

2 Configure eap.conf file

Generate / Install Certificates

In the scripts subdirectory of the FreeRADIUS distribution tarball there is are scripts for creating root, server, and client certificates. It is recommended to get a certificate generated off of a real CA rather than one generated by these utilities since the default action of most wireless clients is to check the certificate being used on the server side against a list of known CAs. Windows’ wireless configuration can relax this requirement by deselecting the checkbox for ‘Validate server certificate.

For PEAP and TTLS only a server certificate needs to be installed. For TLS both a server certificate and a client certificate generated off the same root certificate needs to be installed.

Configure eap.conf file

The eap.conf file contains general information on the handling of EAP packets that are forwarded to the RADIUS server. We will cover the configuration of the file for TLS and for PEAP.

For TLS or PEAP the TLS section needs to be completed. This is because even with PEAP authentication types a secure tunnel is needed from client to server and the TLS section contains the information required to set this tunnel up. Consider the following configuration file listing:

Figure 24: Example eap.conf file

```
eap {
      tls {
            private_key_password = whatever
            private_key_file = ${raddbdir}/certs/cert-srv.pem
            certificate_file = ${raddbdir}/certs/cert-srv.pem
            CA_file = ${raddbdir}/certs/demoCA/cacert.pem
            dh_file = ${raddbdir}/certs/dh
            random_file = ${raddbdir}/certs/random
            fragment_size = 1024
            include_length = yes
            #check_crl = yes
            #check_cert_cn = %{User-Name}
      }
      peap {
            default_eap_type = mschapv2
      }
      mschapv2 {
            }
}
```

The TLS section contains pointers to the server certificate file(s) provided from your Certificate Authority. With the minimal setup shown above (and the properly installed certificates) both TLS and PEAP are active.

Debugging FreeRADIUS

```
radiusd -X
radtest
```

12 RADIUS Attributes

Remote Authentication Dial-In User Service (RADIUS) is an industry standard for providing identification, authentication, authorization, and accounting services for distributed dial-up/remote access networking.

RADIUS Vendor-Specific Attributes (VSAs)

RADIUS Vendor-Specific Attributes (VSAs) are RADIUS Authentication and Accounting attributes defined by vendors to customize information exchanges between clients and servers. This allows unique behaviors to be implemented in client applications without requiring custom server development. VSA support is included directly in dictionary files distributed with RADIUS server products (for example, Funk Steel Belted RADIUS), or can be configured manually on most server products.

Table 26 defines the Extreme Networks VSAs currently implemented in the Summit WM Controller, Access Points, and WM software solution, defined using the Extreme Networks Organizationally Unique Identifier (OUI):

Table 26: Extreme Networks VSAs

Attribute Name	ID	Type	Messages	Description
Extreme-URL-Redirection	1	string	Returned from RADIUS server	A URL that can be returned to redirect a session to a specific Web page.
Extreme-AP-Name	2	string	Sent to RADIUS server	The name of the AP the client is associating to. It can be used to assign policy based on AP name or location.
Extreme-AP-Serial	3	string	Sent to RADIUS server	The AP serial number. It can be used instead of (or in addition to) the AP name.
Extreme-WM-AD-Name	4	string	Sent to RADIUS server	The name of the Virtual Network the client has been assigned to. It is used in assigning policy and billing options, based on service selection.
Extreme-SSID	5	string	Sent to RADIUS server	The name of the SSID the client is associating to. It is used in assigning policy and billing options, based on service selection.
Extreme-BSS-MAC	6	string	Sent to RADIUS server	The MAC address of the BSS-ID the client is associating to. It is used in assigning policy and billing options, based on service selection and location.

RADIUS accounting

Account-Start packet

Table 27 lists the information elements (including VSAs) supported in a RADIUS Start message, issued by Summit WM Controller, Access Points, and WM software, with RADIUS Accounting enabled:

Table 27: Information elements supported in RADIUS Start messages

Attribute	NO.	RAD. Data Type	Name
Acct-Session-Id	44	string	mu_session_id
User-Name	1	string	mu_user_id
Filter-Id	11	string	Filter-Id (Accept-response)
Acct-Interim-Interval	85	integer	(Accept-response/GUI input)
Session-Timeout	27	integer	(Accept-response/GUI input)
Class	25	octets	(Accept-response)
Login-LAT-Group	36	octets	(Accept-response)
Acct-Status-Type	40	integer	Start
Acct-Authentic	45	integer	Radius/Local/Remote
Framed-IP-Address	8	ipaddr	Mu_ip_address
Connect-Info	77	string	802.11 a or 802.11 a/b
NAS-port-type	61	integer	18/19
Called-Station-ID	30	string	BP MAC
Calling-Station-ID	31	string	mu_mac_address
NAS-IP-Address	4	ipaddr	User configurable
NAS-Identifier	32	string	User configurable
Acct-Delay-Time	41	integer	
BP-Serial	VSA	string	Extreme-AP-Serial
BP-Name	VSA	string	Extreme-AP-Name
WM-AD-Name	VSA	string	Extreme-WM-AD-Name
SSID	VSA	string	Extreme-SSID

Account-Stop/Interim packet

Table 28 lists the information elements (including VSAs) supported in a RADIUS Stop or Interim messages, issued by Summit WM Controller, Access Points, and WM software, with RADIUS Accounting enabled:

Table 28: Information elements supported in RADIUS Stop or Interim messages

Attribute	NO.	RAD. Data Type	Name
Acct-Session-Id	44	string	mu_session_id
User-Name	1	string	mu_user_id
Filter-Id	11	string	Filter-Id (Accept-response)
Acct-Interim-Interval	85	integer	(Accept-response/GUI input)

Table 28: Information elements supported in RADIUS Stop or Interim messages (Continued)

Attribute	NO.	RAD. Data Type	Name
Session-Timeout	27	integer	(Accept-response/GUI input)
Class	25	octets	(Accept-response)
Login-LAT-Group	36	octets	(Accept-response)
Acct-Status-Type	40	integer	Stop/Interim-Update
Acct-Terminate-Cause	49	integer	Termination code (only in stop packet)
Acct-Authentic	45	integer	Radius/Local/Remote
Framed-IP-Address	8	ipaddr	Mu_ip_address
Connect-Info	77	string	802.11 a[b][g]
NAS-port-type	61	integer	18/19
Called-Station-ID	30	string	BP MAC
Calling-Station-ID	31	string	mu_mac_address
Acct-Delay-Time	41	integer	
Acct-Session-Time	46	integer	
Acct-Input-Packets	47	integer	
Acct-Output-Packets	49	integer	
Acct-Input-Octets	42	integer	
Acct-Output-Octets	43	integer	
BP-Serial	VSA	string	Extreme-AP-Serial
BP-Name	VSA	string	Extreme-AP-Name
WM-AD-Name	VSA	string	Extreme-WM-AD-Name
SSID	VSA	string	Extreme-SSID

Termination codes

The RADIUS client (Summit WM Controller or AP) terminates the wireless device user's session when one of the following events occur:

- user request
- idle timeout
- session timeout
- administrator reset

When a user session is terminated, the RADIUS client sends a RADIUS accounting stop request that will include one of the following termination codes:

Table 29: Termination codes

Radius Value	Radius Definition	Controller Value	Controller/SMT Definition	Controller Name
1	User Request	9	RF notification that MU has disconnected from Wireless AP. This would be the case if there is a Logoff button for Captive Portal. Normally this would not apply to 802.1X connections.	MU_DEREG_REASON_USER_REQUEST

Table 29: Termination codes (Continued)

Radius Value	Radius Definition	Controller Value	Controller/SMT Definition	Controller Name
4	Idle Timeout	1	User has been disconnected due to idle timeout and inactivity	MU_DEREG_REASON_IDLE_TIMEOUT
5	Session Timeout	7	Disconnection as a result of the maximum session length value indicated by RADIUS server upon Access-Accept, or defined as a default value for the WM-AD.	MU_DEREG_REASON_LIFETIME_TIMEOUT
6	Admin Reset	2 3 8	Explicit request by Management infrastructure (GUI user) to disconnect MU	MU_DEREG_REASON_RF_DICONNECT MU_DEREG_REASON_ADMIN_REQ MU_DEREG_REASON_TUNNEL_DISCONNECT
11	NAS Reboot		BM graceful shutdown	N/A
17	User Error		Unknown reason	N/A

Supported attributes in RADIUS authentication and RADIUS response messages

Table 30 provides a list of the attributes supported in RADIUS authentication and RADIUS response messages.

Table 30: Supported attributes in RADIUS authentication and RADIUS response messages

	MBA on SSID WM-AD	MBA on AAA WM-AD	AAA WM-AD	SSID WM-AD CP Auth (MSCHAP)	SSID WM-AD CP Auth (CHAP)	SSID WM-AD CP Auth (PAP)
Attributes from Radius Server						
Termination-Action	X	X	Y	X		
Login-Lat-Group	Y	X	Y	Y		
Filter-ID	Y	X	Y	Y		
Class	X	Y	Y	Y		
Session-Timeout	Y	Y	Y	Y		
Login-Lat-Port (auth_state)	Y	X	NA	NA		
Acct-Interim-Interval	X	Y	Y	Y		
Tunnel-Private-Group_ID	X	X	Y	X		
MS-MPPE-Recv-Key	NA	NA	Y	NA		
MS-MPPE-Send-Key	NA	NA	Y	NA		

Table 30: Supported attributes in RADIUS authentication and RADIUS response messages (Continued)

	MBA on SSID WM-AD	MBA on AAA WM-AD	AAA WM-AD	SSID WM-AD CP Auth (MSCHAP)	SSID WM-AD CP Auth (CHAP)	SSID WM-AD CP Auth (PAP)
VSAs from Radius Server						
redirection_url	Y	X	NA	Y	Y	Y
Attributes to Radius Server						
User name	Y (ETH-MAC)	Y (ETH-MAC)	Y	Y	Y	Y
BSS-MAC	Y	Y	Y	Y	Y	Y
NAS-IP-Address	Y	Y	Y	Y	Y	Y
NAS-Port	Y	Y	Y	Y	Y	Y
NAS-Port-Type	Y	Y	Y	Y	Y	Y
NAS-Identifier		Y	Y	Y	Y	Y
CHAP-Password	Y (CHAP)	Y (CHAP)	X	X	Y	X
User-Password	Y (PAP)	Y (PAP)	X	X	X	Y
MS-CHAP-Challenge	Y (MSCHAP)	Y (MSCHAP)	X	Y	X	X
MS-CHAP-Response	Y (MSCHAP)	Y (MSCHAP)	X	Y	X	X
Framed MTU			Y			
Called-Station-ID			Y			
Calling-Station-ID			Y			
EAP-Message			Y			
Message-Authenticator			Y			
VSA to Radius Server						
BP-Name	X	X	Y	Y	Y	Y
BP-Serial	X	X	Y	Y	Y	Y
WM-AD-Name	Y	Y	Y	Y	Y	Y
SSID	X	X	Y	Y	Y	Y
BSS-MAC	Y	Y	Y	Y	Y	Y
X= No Y= Yes N= Not Applicable						

RADIUS-based login authentication

To configure RADIUS-based login authentication for the Summit WM Controller, you must configure the Service-Type RADIUS attribute on the RADIUS server. The attribute is returned with the RADIUS access-accept packet, and indicates the privileges a user will have if the user authentication is successful.

The following table describes the Service-Type RADIUS attributes that can be configured on the RADIUS server for RADIUS-based login authentication for the Summit WM Controller.

Table 31: Service-Type attributes

Service-Type value	Name	User privileges
6	Administrative	Full access, read/write
7	NAS prompt	Read-only
No Service-type is configured (default)		Read-only

13 Availability and session availability

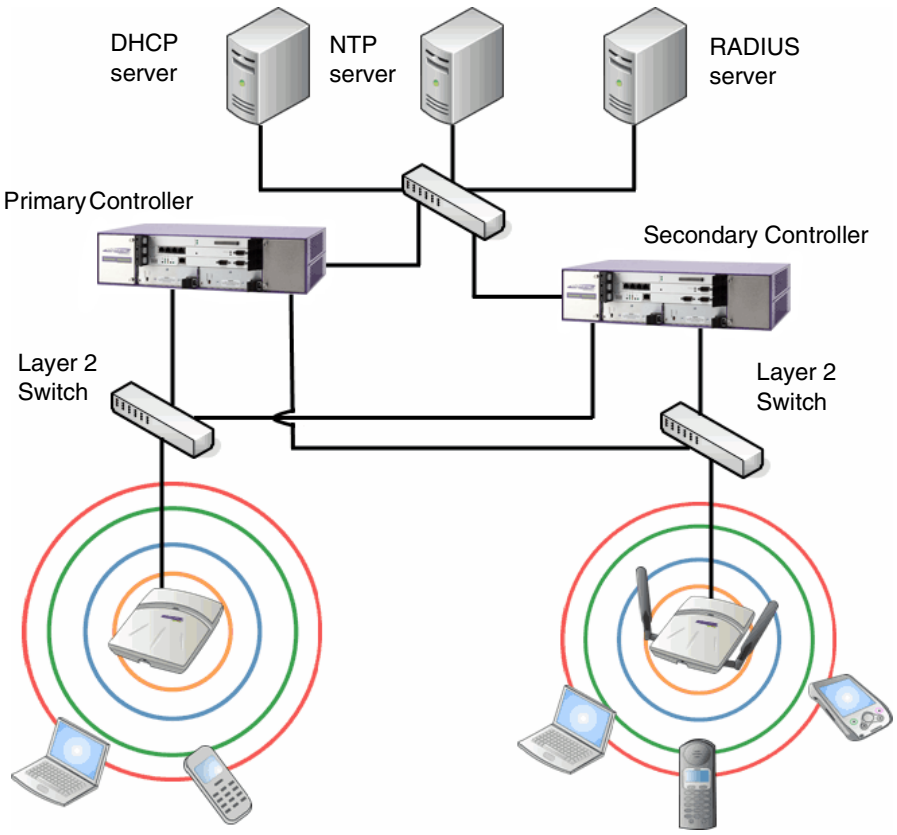
The Summit WM Software system provides the “availability” feature to maintain service availability in the event of a Summit WM Controller outage.

Network topology for fast failover and session availability

The interruption in service for fast failover and session availability should be less than 5 seconds. To achieve fast failover and session availability, a layer 2 networking environment should be employed, as shown in Figure 25.

The 5 second or less traffic interruption is guaranteed for the clients that are associated on session availability enabled WM-ADs and had incoming traffic at the time of the failover. This scenario most often occurs with active voice calls.

Figure 25: Layer 2 networking environment for fast failover and session availability



Fast failover and session availability deployment scenarios

The session availability timing is not guaranteed for setups where there is a WAN link between the Summit WM Controllers or between the Summit WM Controllers and the Wireless APs. In addition, other propagation delays due to network layout may affect session availability performance.

The following describes deployment scenarios when the Altitude AP failover time may be longer than 5 seconds:

- The Altitude AP does not have session availability enabled WM-ADs
- The Altitude AP has session availability enabled WM-ADs, but there are no active clients associated on these WM-ADs
- The Altitude AP has session availability enabled WM-ADs, there are clients associated on these WM-ADs, but there is no incoming traffic for these clients.

When to use fast failover

Fast failover has been designed to allow Wireless APs from a Summit WM Controller to fail over to the surviving Summit WM Controller very quickly. In order to achieve the quick failover result, fast polling between Summit WM Controllers forming availability pairs and between Wireless APs and Summit WM Controllers is required. Because fast polling requires small delays in the network, it is recommended that fast failover is used in switched Ethernet environments.

Although fast failover can be implemented in WAN environments if the appropriate poll timeouts are configured, the 5 second or less traffic interruption is NOT guaranteed in this type of network environment.

14 SNMP MIBs

Summit WM Controller is the main repository of all configuration and statistical data for itself and all Wireless APs, WM-ADs and attached Mobile Units. SNMP is one of the user interfaces to retrieve such information.

For retrieval of such information, Summit WM Controller supports a subset of MIB-II, as well as proprietary MIBs. In implementation of standard MIBs, all Wireless APs and their interfaces are presented as extensions of the Summit WM Controller, as if they are physical interfaces of the Summit WM Controller. Each WM-AD is also presented as one of the interfaces of Summit WM Controller. The supported MIBs are:

- IF-MIB
- RFC1213
- SNMPv2-MIB
- IEEE802dot11-MIB
- EXTREME-SUMMIT-DOT11-EXTS-MIB
- EXTREME-SUMMIT-WM-MIB.my
- EXTREME-SUMMIT-PRODUCT-MIB
- EXTREME-SUMMIT-BRANCH-OFFICE-MIB

NOTE

*When enabling SNMP for a Summit WM Controller, use the **Publish AP as interface of controller** drop-down list to enable or disable publishing the Wireless AP and their interfaces as interfaces of the Summit WM Controller. By default this option is enabled.*

When this option is enabled, all Wireless APs and their interfaces are published as interfaces of the Summit WM Controller when you retrieve topology statistics and configuration information using the SNMP protocol.

*Topology statistics and configuration information on Wireless APs are retrievable using both proprietary and standard MIB. The **Publish AP as interface of controller** option only affects information retrieved through standard MIB, i.e. IF-MIB, RFC1213. All information that is retrieved through proprietary MIB is not affected. If the **Publish AP as interface of controller** option is disabled, the Wireless APs' interfaces are not considered interfaces of the Summit WM Controller.*

*For example, if the **Publish AP as interface of controller** option is disabled, querying the ifTable would return information on the Summit WM Controller physical interfaces, plus all WM-ADs that are configured on that controller. If enabled, querying the same table would return the above information, in addition to information on each Wireless APs' interfaces.*

IF-MIB

Summit WM Controller supports ifTable and ifXTable tables in this MIB. These tables return information about all physical interfaces of Summit WM Controller as well as WM-ADs as interface objects and Wireless AP interfaces. The description of each interface helps identify the interface object.

For example, WM-AD interface description is the name of the WM-AD and each Wireless AP has three interfaces—one wired and two radio. The wired interface of the Wireless AP is named by concatenation of the Wireless AP's name and word "_ethernet" and each radio interface is named by concatenation of the Wireless AP's name and the radio type. The following are examples of some of the interfaces with arbitrary indices.

- Some of the physical ports of the Summit WM Controller:

  ifDesc.1 = esa0

  ifDesc.2 = esa1

- WM-AD by the name "roaming":

  ifDesc.7 = roaming

- Wireless AP with serial number 1122334455667788 (assuming the arbitrary indices of 100, 101 and 102):

  Wired interface: ifDesc.100 = 1122334455667788_ethernet

  802.11b/g radio: ifDesc.101 = 1122334455667788_802.11b/g

  802.11a radio: ifDesc.102 = 1122334455667788_802.11a

Interfaces are numbered starting from Summit WM Controller's physical ports, with the exception of eth0 interface that is indexed at 99, then WM-AD interfaces and finally Wireless AP interfaces. Summit WM Controller physical interfaces are numbered from one, (for example esa0, esa1, esa2) with indices 1, 2, 3 respectively.

WM-AD indices begin following the esaXX ports. Wireless AP interface numbering begins following the WM-ADs and the first Wireless AP wired interface is given the lowest interface number starting at 100. Each radio occupies the next indices (For example, 101 for radio B/G and 102 for radio A). The next Wireless AP and its interface occupy the next available interface number.

RFC1213

This MIB is fully supported and Summit WM Controller's system related information can be obtained through this MIB. Other information such as IP addresses of interfaces, SNMP stats or IP routing are retrievable through this MIB as well.

IEEE802dot11-MIB

Summit WM Controller supports the following tables/groups defined in this MIB:

- dot11StationConfigTable
- dot11PrivacyTable
- dot11OperationTable
- dot11CountersTable
- dot11res.dot11resAttribute
- dot11PhyOperationTable
- dot11RegDomainsSupportedTable
- dot11SupportedDataRatesTxTable

- dot11SupportedDataRatesRxTable.

Proprietary MIBs

Our proprietary MIBs can be used to retrieve useful information about the system as a whole.

EXTREME-SUMMIT-WM-MIB.my

The main groups and tables defined in this MIB are:

- **systemObects** – The types of information that can be retrieved from this group includes software and hardware information, information of physical interfaces, DNS information, and tunneling information.
- **virtualNetworks** – This group provides us all details information about all configured WM-ADs and their attributes such as IP addresses, Radius information, and DHCP.
- **accessPoints** – This group provides information about all Wireless APs and their attributes.
- **mobileUnits** – This group provides information about mobile units associated with the Summit WM Controller.
- **association** – Provides statistics about mobile units attached to the Summit WM Controller.

EXTREME-SUMMIT-WM-DOT11-EXTS-MIB

This MIB complements the IEEE802dot11-MIB in retrieving configuration or statistical information proprietary to Summit WM Controller. Some examples of this information include:

- Mobile unit association information (assocGroupTable and assocCountersTable).
- SSID can be accessed through the dot11ExtBSSIDTable.

EXTREME-SUMMIT-PRODUCT-MIB

This MIB contains object identifiers (OID) for Summit WM products.

EXTREME-SUMMIT-WM-BRANCH-OFFICE-MIB

Branch office information can be obtained using this MIB.

15 DRM – Dynamic Radio Management

The performance and reliability of a WLAN network is becoming increasingly important as more and more applications are switching from wired to wireless, which places more users into the same wireless space. In addition, WLAN applications have expanded to include VoIP, real-time, and mission-critical services that place extra demands on network performance and reliability. Under normal circumstances, i.e. proper wired infrastructure with proper QoS settings, the quality of the RF environment actually determines the performance of the WLAN network.

- Automatic Channel Selection (ACS)
- Automatic Transmit Power Control (ATPC)
- Dynamic Channel Selection (DCS)

For more information on how to use these features, see the following:

- *Summit WM User Guide*
- *Summit WM Solutions Guide*

Automatic Channel Selection (ACS) overview

ACS provides an easy way to optimize the channel arrangement based on the current situation in the field. ACS relies on the RF environment measurements as seen by the Altitude AP, and therefore it is more accurate than any other method. However, it is very important to understand and avoid its limitations.

ACS provides an optimal solution only if it is triggered on all Wireless APs in a deployment. Triggering ACS on a single Wireless AP or on a subset of Wireless APs provides a useful, but suboptimal, solution. Also, ACS only relies on the information observed at the time it is triggered and does not take into account the history or the future RF environment. Once a Wireless AP has selected a channel, it will remain operating on that channel until the user changes the channel or triggers ACS.

ACS can be triggered by one of the following events:

- A new Wireless AP registers with the Summit WM Controller and the Altitude AP default settings for **Channel** is **Auto**.
- A user clicks **Auto** in the **Request New Channel** drop-down list on the radio properties tabs of the Summit WM GUI.
- The user clicks **Auto** in the **Channel** drop-down list on the **AP Multi-edit** page.
- An Altitude AP detects radar on its current operating channel, which triggers ACS to select a new channel.
- DCS detects the current channel is no longer usable which triggers ACS to select a new channel.

ACS operates independently on the two radios of an Altitude AP; when ACS is simultaneously triggered on both radios, the result for each radio will be the same as if ACS was triggered separately on each radio.

If ACS is triggered only on one Wireless AP and one radio, that Wireless AP will scan all available channels for that radio and then select the best channel and begin operating on that channel (according to the criteria described below). If ACS is triggered simultaneously on multiple Wireless APs, the Wireless APs will synchronize and cooperate in the process of selecting channels. This helps to avoid multiple Wireless APs jumping on the same channel because it looks free.

Automatic Transmit Power Control (ATPC) overview

Each Altitude AP with ATPC enabled will look at the closest (in terms of RF attenuation) Altitude AP operating on the same channel with ATPC enabled, and will adjust Tx power depending on the attenuation toward the closest Altitude AP.

NOTE

ATPC does not rely on the received signal strength. Instead, it relies on the RF attenuation between Wireless APs, which is the difference between the power level at the transmitter and the received signal strength. Therefore, when the Tx power changes on one Altitude AP, it will not induce Tx power changes on the neighboring Wireless APs.

ATPC, if used properly, can significantly improve the reliability of the network by monitoring the RF environment and adjusting the Tx power of the Wireless APs in order to compensate for changes in the RF environment. For example:

- If an obstructing object is installed in a room, ATPC will increase the Tx power for one or more of the neighboring Wireless APs to compensate.
- If an empty room fills with people, ATPC will increase the Tx power for the Wireless APs in the room to compensate.
- If one or more Wireless APs go out of service, ATPC will increase the TX power for their neighbors in an attempt to fill in the coverage hole.

However, it is important to note the following:

- The ATPC algorithm does not know the desired coverage footprint for a Wireless AP so it is not a replacement for a site survey. However, it is a good addition to the site survey.
- ATPC cannot always fully compensate for the changes in the RF environment because even the maximum allowed Tx may not be enough and because the Wireless AP has a limited view of the actual degradation.

Dynamic Channel Selection (DCS) overview

DCS monitors the operating channel and triggers a channel change, via ACS, when the conditions on the operating channels worsen beyond user-defined thresholds. The thresholds are configured on the radio properties tabs of the Summit WM GUI. The two parameters DCS monitors are channel utilization and noise floor.

DCS has two modes of operation:

- Monitor – DCS only monitors the channel utilization and noise floor and issues an alarm when the user-defined thresholds are exceeded.
- Active – DCS monitors the channel utilization and noise floor and triggers a channel change, via ACS, when the user-defined thresholds are exceeded.

16 Call Admission Controls, TSPEC, and QoS

Summit WM WLAN supports TSPEC as related to the 802.11e standard, with the following capabilities:

- Admission Control (AC) for the voice and video traffic class is configurable per WM-AD.
- Medium time calculation and management is configured via the **Global Settings** page.
  - Recalculation of the available medium time occurs once per second.
  - Acceptance is based on the availability thresholds for new and roaming clients, which is configured on the **Wireless QoS** tab.
  - Configure the deletion of TPSEC due to medium violations by enabling the **Send DELTS to Client** option on the **QoS Policy** tab.
- Accept non-TSPEC clients on the access control enabled WM-AD:
  - Optionally downgrade downlink packets to non-access controlled priority, if necessary.
  - If enabled, force a deauthentication of the client sending uplink packets using a controlled class (i.e. voice or video).
- QBSS Load IE announcement in the Beacon and Probe Response.
- Support for both 802.11e IE and WMM IE in the management frames
- The 802.11 management frame will include the 802.11e IEs when generated by the AP. The AP processes the 802.11 management frame, which contains the 802.11e IE, when it is received. The negotiation between the AP and client is as follows:
  - Beacon is generated by the AP.
  - Probe is received by the AP.
  - Probe response is generated by the AP.
  - Association/reassociation request is generated by the client.
  - Association/reassociation response is generated by the AP.
- Ability to communicate with both 802.11e and WMM-enabled clients.
- TSPEC negotiation with the client is based on ADDTS-Request, ADDTS-Resp, and DELTS including support for uplink, downlink, and bi-directional traffic.
- TSPEC timeout and TSPEC Suspension (802.11e specific) is not supported.
- TSPEC enforcement using policer is configured using the **Advanced Wireless QoS** options on the **QoS Policy** tab:
  - Uplink Policer Action:
    - **Do Nothing** (default)
    - **Send DELTS to client**
  - Downlink Policer Action:
    - **Do Nothing** (default)
    - **Downgrade**
    - **Drop**
- The **Admission Control Statistics by Altitude AP** report for each client TSPEC includes:
  - Access category (AC)

- Direction
- Mean data rate (MDR) (bps)
- Nominal MSDU size (NMS) (bytes)
- Surplus bandwidth allowance (SBA) (ratio)
- Downlink rate (bps)
- Uplink rate (bps)
- Downlink violations (bps)
- Uplink violations (bps)

17 Portable and text editable backup

When working with the portable text editable backup files, use Windows WordPad or a code editor such as Source Insight or vi for a Linux system.

NOTE

When working with the portable text editable backup files, do not use Windows Notepad to edit the .cli file. Notepad displays the contents of the .cli file in a disorganized manner.

Working with supported files

A text editable backup file that can be imported into a Summit WM Controller must end with either a .cli or .zip file extension. The CLI commands copy restore or copy import can be used to copy both the .cli or .zip files back onto the Summit WM Controller.

.cli file

The .cli file can have any name. For example, when you are working with the controller_config.cli file you can do the following:

- Extract the *.zip file.
- Modify the contents of the extracted controller_config.cli file.
- Rename the controller_config.cli.
- Import the revised .cli file.

Order dependent

The *.cli file is order dependent. For example, when you modify the contents of the .cli file (add, modify, or delete components), the contents of the file must follow the existing order. If the order of the revised components is changed, it could create errors in CLI.

.zip file

The .cli file must be stored in the root directory of the .zip file. For example, when you are working with the .zip file you can do the following:

- Extract the *.zip file.
- Modify the contents of the extracted controller_config.cli file.
- Compress the files with the .cli file at the root directory.

NOTE

The .cli file cannot be in a subdirectory when the .zip file is compressed.

Migration of the text editable backup files

- If a text editable backup file is migrated to a different Summit WM Controller, the management port (eth0) and management gateway values in the .cli file must be revised to match the existing network configuration.
- If a text editable backup file is migrated from a large capacity Summit WM Controller to a lower capacity Summit WM Controller, for example from a WM200/2000 to a WM20 controller, license limitation errors will be generated. These errors can be seen in the Restore/Import logs once the import process has completed. When you attempt to log in to the Summit WM GUI, you will be informed that the restore process has failed and you will be provided a link that directs you to the error log.

  NOTE

  When migrating from a large capacity Summit WM Controller to a lower capacity Summit WM Controller, it is recommended to remove extra ports and WM-ADs from the configuration file to avoid generating errors.

- The entire running process file can only be retrieved using the CLI command tech_support log.

18 Logs and Events

The Summit WM Controller is designed to behave like an appliance. It is either in an operational state, or it has failed due to a hardware problem or low level packet processing issue. In general, the system will self recover by rebooting if the system fault is recoverable.

There are two main monitoring processes in the system:

- a hardware watchdog
- a software watchdog

The software watchdog restarts stalled or failed processes, while the hardware watchdog causes system reboot should the software watchdog fail. The result of this approach is that little intervention is required once the system is properly configured and operational.

STARTUP_MANAGER (0)

Table 32: STARTUP_MANAGER (0) logs and events

Log ID	Log Message	Comment	Action
Critical			
2	Failed attempting to start router ports. System reboot initiated.	Internal communication problem. Possible misconfiguration of system.System will Restart	If problem persists, contact Technical Support to investigate.
3	Internal connection to router ports lost. Restart initiated.	Internal communication problem. Possible misconfiguration of system. System will restart.	If problem persists, contact Technical Support to investigate.
4	HSM failed to start. System reboot initiated.	Internal communication problem. Possible misconfiguration of system. System will restart.	If problem persists, contact Technical Support to investigate.
5	HSM is down. System reboot initiated	Internal communication problem. Possible misconfiguration of system. System will restart.	If problem persists, contact Technical Support to investigate.
6	HSM failed to reply to status notification. System reboot initiated.	Internal communication problem. Possible misconfiguration of system. System will restart.	If problem persists, contact Technical Support to investigate.
7	Failed to connect to Langley. System reboot initiated.	Internal communication problem. Possible misconfiguration of system. System will restart.	If problem persists, contact Technical Support to investigate.

Table 32: STARTUP_MANAGER (0) logs and events (Continued)

Log ID	Log Message	Comment	Action
Major			
9	Unable to start component [%d]. Services provided by the component will be unavailable.	Internal component problem.	If problem persists, contact Technical Support to investigate.
20	Component [%d] is down. Component will be restarted.	Internal component became inactive. Component will restart.	If problem persists, contact Technical Support to investigate.
21	Component [%s] is down. Component will be restarted.	Internal component became inactive. Component will restart.	If problem persists, contact Technical Support to investigate.
Minor			
33	Process/component [%d] restarted.	Inactive component has been re-activated. In general re-activation occurs within 1 s.	None
Info			
65	Component [%d] started as part of normal start-up.	Normal system operation	None
66	Component [%d] stopped due to end-user request.	Feature configuration change has caused a component to restart.	None
67	System shutdown requested by Web/CLI.	Administrator has requested system shutdown	None
68	System reboot requested by Web/CLI.	Administrator has requested system shutdown	None
69	Connected to Event Server - event logging starts.	Normal system operation	None
71	Service [%s] is being restarted.	n/a	None
Trace			
129	Sending Message. Origin %d Destination %d Action % Status %.		
130	Socket [%d] connected.		
131	Startup API: Unable to connect to SMT.		
132	Startup API: Socket error [%d].		
133	Startup API: Generic socket connection error [%d].		
134	Received Message. Origin %d Destination %d Action % Status %.		
135	Received Web/CLI message.		
136	Received invalid Web/CLI message.		
137	Startup manager can't connect to component listener.		
138	Component [%d] disconnected.		
139	Component [%d] connected.		

Table 32: STARTUP_MANAGER (0) logs and events (Continued)

Log ID	Log Message	Comment	Action
140	Error creating socket. Errno: %d		
141	Error binding socket. Errno: %d		
142	Socket address already in use.		
143	Unable to connect to socket. Errno: %d		
144	Startup API socket accept error. Errno: %d		
145	Startup API socket select error. Errno: %d		
146	Connected to component [%d].		

EVENT_SERVER (1)

Table 33: EVENT_SERVER (1) logs and events

Log ID	Log Message	Comment	Action
Critical			
1	Failed to create thews thread.	Internal Component Failure. Log system may not be working properly.	If problem persists, contact Technical Support to investigate.
2	Critical internal error - log file protection flags have been corrupted. Event server will halt.	Internal Component Failure. Log system may not be working properly.	If problem persists, contact Technical Support to investigate.
3	Internal system interrupt handlers failed to initialize. Event server will halt.	Internal Component Failure. Log system may not be working properly.	If problem persists, contact Technical Support to investigate.
4	Unable to initialize internal program thread. Event server will halt.	Internal Component Failure. Log system may not be working properly.	If problem persists, contact Technical Support to investigate.
5	Memory allocation failure. Unable to log last event.	Internal Component Failure. Log system may not be working properly.	If problem persists, contact Technical Support to investigate.
6	Socket call failed. Will not be able to communicate with specific component. Error no:%d.	Internal Component Failure. Log system may not be working properly.	If problem persists, contact Technical Support to investigate.
7	Socket select error - 100% CPU utilization can occur and overall system performance will be impaired.	Internal Component Failure. Log system may not be working properly.	If problem persists, contact Technical Support to investigate.

Table 33: EVENT_SERVER (1) logs and events (Continued)

Log ID	Log Message	Comment	Action
8	The evaluation license for the controller has expired. Please contact your customer representative and purchase licenses to continue using the controller. If you do not purchase a license, the legal requirement is to put the system out of service.	System operation is severely restricted by lack of valid license.	Contact Sales Support ASAP to request new License
Major			
9	The controller evaluation license will expire inns days. Please contact your customer representative and purchase licenses to continue using the controller.	System operation is severely restricted by lack of valid license. Contact Sales support to request new license	If problem persists, contact Technical Support to investigate.
10	Audit message error. Unable to log audit message.	Internal Component Failure. Log system may not be working properly. Failed to log configuration change.	If problem persists, contact Technical Support to investigate.
11	Unknown internal program message received - type%d. Message will be ignored and processing continued.	Component out of sync with database. Log system may not be working properly.	If problem persists, contact Technical Support to investigate.
12	Low water mark level was reached!	Log message system log information. No action required.	None
13	High water mark level was reached. Dropping all log messages and AP alarms!	Too many outstanding logs. Log system may not be working properly.	If problem persists, contact Technical Support to investigate.
14	Failed to connect to the infrastructure bus.	Internal Component Failure. Log system may not be working properly. Failed to log configuration change.	If problem persists, contact Technical Support to investigate.
15	Unable to determine trace file size - Error no:%d. Message will be dropped.	Internal Component Failure. Log system may not be working properly. Failed to log configuration change.	If problem persists, contact Technical Support to investigate.
16	Unable to open audit file - Error no:%d. Message will be dropped.	Internal Component Failure. Log system may not be working properly. Failed to log configuration change.	If problem persists, contact Technical Support to investigate.
17	Unable to determine audit file size - Error no:%d. Message will be dropped.	Internal Component Failure. Log system may not be working properly. Failed to log configuration change.	If problem persists, contact Technical Support to investigate.
18	Cannot write to file - Error no:%d. Message will be dropped.	Internal Component Failure. Log system may not be working properly. Failed to log configuration change.	If problem persists, contact Technical Support to investigate.
19	File pointer information corrupted - File sized. Message will be dropped.	Internal Component Failure. Log system may not be working properly. Failed to log configuration change.	If problem persists, contact Technical Support to investigate.

Table 33: EVENT_SERVER (1) logs and events (Continued)

Log ID	Log Message	Comment	Action
20	Cannot reset file pointer to beginning of the log file - Error no:%d. The message and subsequent messages will be dropped.	Internal Component Failure. Log system may not be working properly. Failed to log configuration change.	If problem persists, contact Technical Support to investigate.
21	Trying to read non-empty file - Error no:%d. Message will be dropped.	Internal Component Failure. Log system may not be working properly. Failed to log configuration change.	If problem persists, contact Technical Support to investigate.
22	Cannot reset audit file pointer to beginning of the audit file - Error no:%d. The message and subsequent messages will be dropped.	Internal Component Failure. Log system may not be working properly. Failed to log configuration change.	If problem persists, contact Technical Support to investigate.
23	Cannot set audit file pointer to specific position in the log - Error no:%d. The message and subsequent messages will be lost.	Internal Component Failure. Log system may not be working properly. Failed to log configuration change.	If problem persists, contact Technical Support to investigate.
24	Cannot reset log file pointer to beginning of log file - Error no:%d. The message and subsequent messages will be dropped.	Internal Component Failure. Log system may not be working properly. Failed to log configuration change.	If problem persists, contact Technical Support to investigate.
25	Cannot reset audit file pointer to specific position in the audit file - Error no:%d. The message and subsequent messages will be dropped.	Internal Component Failure. Log system may not be working properly. Failed to log configuration change.	If problem persists, contact Technical Support to investigate.
26	Cannot reset trace file pointer to beginning of the trace file - Error no:%d. The message and subsequent messages will be dropped.	Internal Component Failure. Log system may not be working properly. Failed to log configuration change.	If problem persists, contact Technical Support to investigate.
27	Cannot reset trace file pointer to specific position in the trace file - Error no:%d. The message and subsequent messages will be dropped.	Internal Component Failure. Log system may not be working properly. Failed to log configuration change.	If problem persists, contact Technical Support to investigate.
28	Message has been written to the log but an error was encountered when closing the file - Error no:%d.	Internal Component Failure. Log system may not be working properly. Failed to log configuration change.	If problem persists, contact Technical Support to investigate.
29	Unable to open AP detection log file - Error no:%d. Message will be dropped.	Failure in Rogue AP Detection Logging. Reporting of rogue devices may be affected. Only relevant if Summit WM series Spy is enabled.	If problem persists, contact Technical Support to investigate.
30	Unable to determine AP detection log file size - Error no:%d. Message will be dropped.	Failure in Rogue AP Detection Logging. Reporting of rogue devices may be affected. Only relevant if Summit WM series Spy is enabled.	If problem persists, contact Technical Support to investigate.

Table 33: EVENT_SERVER (1) logs and events (Continued)

Log ID	Log Message	Comment	Action
31	Cannot reset AP detection log file pointer to beginning of file - Error no:%d. The message and subsequent messages will be dropped.	Failure in Rogue AP Detection Logging. Reporting of rogue devices may be affected. Only relevant if Summit WM series Spy is enabled.	If problem persists, contact Technical Support to investigate.
32	Cannot set AP detection log file pointer to specific position in the log - Error no:%d. The message and subsequent messages will be lost.	Failure in Rogue AP Detection Logging. Reporting of rogue devices may be affected. Only relevant if Summit WM series Spy is enabled.	If problem persists, contact Technical Support to investigate.
Minor			
33	Invalid index [%d].		
34	File stream [%s] not open.		
35	Invalid page size [%d].		
36	Error reading the payload. Dropping the message!		
37	Invalid timestamp for message index [%d].		
38	Invalid direction.		
39	Failed to delete old exported file [%s].	Old Log file has remained in the system and may affect ability to export further reports. Contact Technical Support to investigate	If problem persists, contact Technical Support to investigate.
40	Cannot export image. There already are [%d] images exported.	Too many reports open. Close some reports and retry.	If problem persists, contact Technical Support to investigate.
41	Failed to receive message.	n/a	n/a
42	Incoming message dropped, because of the rate limiting mechanism.	n/a	n/a
43	Unable to format msg from index [%d].	Problem interpreting log message. Log entry may not be performed. Low impact to the system.	If problem persists, contact Technical Support to investigate.
44	Unknown message type [%d].	Problem interpreting log message. Log entry may not be performed. Low impact to the system.	If problem persists, contact Technical Support to investigate.
45	Error reading property [%s].	Problem interpreting log message. Log entry may not be performed. Low impact to the system.	If problem persists, contact Technical Support to investigate.
46	Wrong bitmask size [%d].	Problem interpreting log message. Log entry may not be performed. Low impact to the system.	If problem persists, contact Technical Support to investigate.
47	Payload initialization failed for message type [%d].	Problem interpreting log message. Log entry may not be performed. Low impact to the system.	If problem persists, contact Technical Support to investigate.

Table 33: EVENT_SERVER (1) logs and events (Continued)

Log ID	Log Message	Comment	Action
48	Invalid information [%d]. Dropping the message.	Problem interpreting log message. Log entry may not be performed. Low impact to the system to the System.	If problem persists, contact Technical Support to investigate.
49	Invalid length [%d] for AP serial number.	Problem interpreting log message. Log entry may not be performed. Low impact to the system to the System.	If problem persists, contact Technical Support to investigate.
50	Failed to extract SNMP PDU.	Problem interpreting log message. Log entry may not be performed. Low impact to the system to the System.	If problem persists, contact Technical Support to investigate.
51	Decoded SNMP PDU is NULL.	Problem interpreting log message. Log entry may not be performed. Low impact to the system to the System.	If problem persists, contact Technical Support to investigate.
52	Failed to update entries from PDU. Error [%d].	Problem interpreting log message. Log entry may not be performed. Low impact to the system to the System.	If problem persists, contact Technical Support to investigate.
53	Invalid severity ID [%d].	Problem interpreting log message. Log entry may not be performed. Low impact to the system to the System.	If problem persists, contact Technical Support to investigate.
54	Invalid AP alarm severity [%d].	Problem interpreting log message. Log entry may not be performed. Low impact to the system to the System.	If problem persists, contact Technical Support to investigate.
55	Failed to send formatted log message.	Problem interpreting log message. Log entry may not be performed. Low impact to the system to the System.	If problem persists, contact Technical Support to investigate.
56	Invalid OIDs in the AP alarm PDU.	Problem interpreting log message. Log entry may not be performed. Low impact to the system to the System.	If problem persists, contact Technical Support to investigate.
57	No entries found in the AP alarm PDU.	Problem interpreting log message. Log entry may not be performed. Low impact to the system to the System.	If problem persists, contact Technical Support to investigate.
58	Unable to get value from [%s].	Problem interpreting log message. Log entry may not be performed. Low impact to the system to the System.	If problem persists, contact Technical Support to investigate.
59	[%s] not set in the AP alarm.	Problem interpreting log message. Log entry may not be performed. Low impact to the system to the System.	If problem persists, contact Technical Support to investigate.
60	SNMP encode failed.	Problem interpreting log message. Log entry may not be performed. Low impact to the system to the System.	If problem persists, contact Technical Support to investigate.

Table 33: EVENT_SERVER (1) logs and events (Continued)

Log ID	Log Message	Comment	Action
61	Message [%d] processing failed.	Problem interpreting log message. Log entry may not be performed. Low impact to the system to the System.	If problem persists, contact Technical Support to investigate.
62	Invalid sort type [%d].	Problem interpreting log message. Log entry may not be performed. Low impact to the system to the System.	If problem persists, contact Technical Support to investigate.
63	Unable to initialize array [%s].	Possible problem with logging system. If problem persists	If problem persists, contact Technical Support to investigate.
64	Invalid component index [%d].	Problem interpreting log message. Log entry may not be performed. Low impact to the system to the System.	If problem persists, contact Technical Support to investigate.
Info			
65	The log message database is being optimized. Log entries prior to this point in time will be temporarily unavailable.	Info.Temporary outage of log system. No action required.	None
66	No messages in the table.	Request for an empty log.	None
67	Bitmask was set to [%s].	Administrative change to log/ trace bitmask.	None
68	Sending messages to syslog feature is enabled.	n/a	None
69	Sending audit records to syslog feature is enabled.	n/a	None
70	Status request dropped. It was not sent for the Event Server.	No impact.	None
71	Unable to delete msg from view.	Possible problem with logging system.	If problem persists, contact Technical Support to investigate.
72	Unable to persist [%s] msg.	Possible problem with logging system.	If problem persists, contact Technical Support to investigate.
73	Failed to execute command [%s].	Possible problem with logging system.	If problem persists, contact Technical Support to investigate.
74	Unable to send log report response.	Possible problem with logging system.	If problem persists, contact Technical Support to investigate.
75	Unable to receive indexes for requested msgs.	Possible problem with logging system.	If problem persists, contact Technical Support to investigate.
76	No messages to export for the specified log type [%d].	Possible problem with logging system.	If problem persists, contact Technical Support to investigate.
77	Exported image already exists [%s].	Possible problem with logging system to the System.	If problem persists, contact Technical Support to investigate.

Table 33: EVENT_SERVER (1) logs and events (Continued)

Log ID	Log Message	Comment	Action
78	Exported image file [%s] cannot be opened.	Possible problem with logging system.	If problem persists, contact Technical Support to investigate.
79	Invalid AP SN [%s].	Possible problem with logging system.	If problem persists, contact Technical Support to investigate.
80	Invalid sort criteria [%s].	Possible problem with logging system.	If problem persists, contact Technical Support to investigate.
81	Unable to clear AP critical alarm. Alarm ID [%d].	Possible problem with logging system.	If problem persists, contact Technical Support to investigate.
82	Unable to send log export response.	Possible problem with logging system.	If problem persists, contact Technical Support to investigate.
83	Invalid page request [%d].	Possible problem with logging system.	If problem persists, contact Technical Support to investigate.

CONFIG_MANAGER (2)

Table 34: CONFIG_MANAGER (2) logs and events

Log ID	Log Message	Comment	Action
Critical			
1	Config Manager has suffered a critical error and will halt. Error Details:%s	OAM configuration system restarts due to internal error. Active Configuration request may not have been processed. System will restart configuration manager.	If problem persists, contact Technical Support to investigate.
2	Access point controlled software upgrade has failed. This normally occurs if a corrupt image file was selected as the upgrade image. Please select another image for the upgrade:%s	Access Point upgrade fails. AP may be prevented to register with controller due to configuration mismatch.	If problem persists, contact Technical Support to investigate.
3	Access point automatic software upgrade/downgrade has failed. This normally occurs if a corrupt image file was selected as the default image. Please select another default image. This alarm will repeat as long as the system is in automatic mode:%s	Access Point upgrade fails. AP may be prevented to register with controller due to configuration mismatch.	If problem persists, contact Technical Support to investigate.

Table 34: CONFIG_MANAGER (2) logs and events (Continued)

Log ID	Log Message	Comment	Action
4	An AP has encountered an error processing configuration. Error details:%s	Access Point failed to process configuration set. AP is not able to provide service. Verify AP Image version to validate that controller and AP are properly matched.	If problem persists, contact Technical Support to investigate.
Major			
9	Config Manager has experienced an error which has prevented it from properly processing a request. CM will continue running, however this error may be an indicator of a larger system problem. Error Details:%s	Configuration/Administration request may not have been properly processed.	If problem persists, contact Technical Support to investigate.
10	Access point%s has reported a radar interference violation on%s. The affected radio(s) have been placed in auto channel select mode, and will not respond to channel changes until 30min after the radar interference is last detected.	Information. AP has responded to Radar signal information.	None
11	AP [%s] has not responded to a configuration change. The AP has been sent a reboot notification.	Access Point failed to acknowledge configuration set. AP may not be not be able to provide service. Verify AP Image version to validate that controller and AP are properly matched.	If problem persists, contact Technical Support to investigate.
Minor			
33	Config Manager has failed to process a request. Config Manager is still running, and system functionality is not impaired. Error Details:%s	Configuration/Administration request may not have been properly processed.	If problem persists, contact Technical Support to investigate.
Info			
65	Shutdown sequence initiated.	System is shutting down in response to administration operation (explicit request, software upgrade, license key, etc....)	None
66	Shutting down normally.	System is shutting down in response to administration operation (explicit request, software upgrade, license key, etc....)	None
70	New product key has been applied. Wireless Controller will be rebooted.	System is shutting down in response to administration operation (explicit request, software upgrade, license key, etc....)	None
	Config succeeded. Serial number:%s	Successful confirmation of AP configuration.	None

Table 34: CONFIG_MANAGER (2) logs and events (Continued)

Log ID	Log Message	Comment	Action
	Config failed. Serial number:%s	Access Point upgrade fails. AP may be prevented to register with controller due to configuration mismatch.	If problem persists, contact Technical Support to investigate.
	Unable to retrieve MAC address from AP	AP reports may be affected. Will not be able to determine BSSID for WM-AD assignment reports. Other feature impact such as RogueAP	If problem persists, contact Technical Support to investigate.
	Upgrading AP%s image from%s to%s	AP Image upgrade.	None
	Software version matches. Serial number:%s	Ap is running adequate firmware version. AP Registration will proceed	None
	Cannot send syslog enable notify.	Possible impact to Log System configuration in terms of logging to external log system. Retry applying syslog configuration.	If problem persists, contact Technical Support to investigate.
	Software config response sent out. Serial number:%s	Configuration of AP	None
	Upgrading Sensor (%s) image to ftp:%s to path:%s	AP role change	None
	Initial channel report has been successfully sent to AP. Serial number:%s	AP Channel report Feature	None
	Subsequent channel report has been successfully sent to AP. Serial number:%s	AP Channel report Feature	None
Trace			
129	entering handler for CIA message %d		
130	%s		

STATS_SERVER (3)

Table 35: STATS_SERVER (3) logs and events

Log ID	Log Message	Comment	Action
Critical			
1	Statistics Server suffered an internal connection failure. Retrying connection in 5 seconds.	Internal Component Problem. Stats Server unable to establish proper inter-process communications. May affect system status reports, user accounting and CDRs.	If problem persists, contact Technical Support to investigate.

Table 35: STATS_SERVER (3) logs and events (Continued)

Log ID	Log Message	Comment	Action
Minor			
33	Unable to create thread to register callbacks to Startup Manager. Stats Server will continue, but will be unable to respond to Startup Manager requests.	Internal Component Problem. Major component functions not affected.	If problem persists, contact Technical Support to investigate.
35	Unable to start timer thread necessary to collect router port SNMP statistics	Affects ability to report statistic utilization of system interfaces. No deterrent effect to system operation other than to interface reports.	If problem persists, contact Technical Support to investigate.
36	Received empty AP bundle statistics record: There may be no active APs connected to the system.	n/a	None
37	Unable to determine local physical ports on system; port statistics will not be collected.	Affects ability to report statistic utilization of system interfaces. No deterrent effect to system operation other than to interface reports.	If problem persists, contact Technical Support to investigate.
Info			
65	Shutdown sequence initiated.	Administrator has requested system shutdown	None
66	Shutting down normally.	Administrator has requested system shutdown	None
67	Received shutdown request from SMT	n/a	None
68	Successfully connected to internal data sources.	n/a	None
69	Null input parameters received; ignoring message.	Minor internal communications issue.	If problem persists, contact Technical Support to investigate.
70	Request for router port SNMP statistics failed. No statistics reported for interval.	Affects ability to report statistic utilization of system interfaces. No deterrent effect to system operation other than to interface reports.	If problem persists, contact Technical Support to investigate.
72	Request for vnMgr statistics failed. No statistics will be reported for interval.	No deterrent effect to system functional operation. Affects ability to report Mobility domain statistics.	If problem persists, contact Technical Support to investigate.
Trace			
129	Received unexpected CIA message		
130	Received IXP_MU_STATS_BUNDLE_NOTIFY message		
131	Received IXP_RU_STATS_BUNDLE_NOTIFY message		

Table 35: STATS_SERVER (3) logs and events (Continued)

Log ID	Log Message	Comment	Action
132	Received ES_LOG_LVL_UPDATE_NOTIFY message		
133	Received IXP_RU_STATS_NOTIFY_MSG		
134	Received IXP_RU_STATS_NOTIFY message		
135	Received IXP_MU_DEREGISTER_NOTIFY message		
136	Received IXP_RU_DISCONNECT_NOTIFY message		
137	Received VN_MGR_STATS_NOTIFY message		
138	Received response for IXP SNMP port statistics		

SECURITY_MANAGER (4)

Table 36: SECURITY_MANAGER (4) logs and events

Log ID	Log Message	Comment	Action
Critical			
1	Cannot allocate memory. Will not be able to process Captive portal authentication request.	Internal operation failure. Affects ability to provide authentication Token for Captive Portal session. User may retry again. Memory allocation indication may indicate problem with system resource utilization.	If problem persists, contact Technical Support to investigate.
2	Failed to initialize list of session tracking tags (token). Will not be able to process Captive portal authentication requests.	Internal operation failure. Affects ability to provide authentication Token for Captive Portal session. User may retry again to succeed.	If problem persists, contact Technical Support to investigate.
3	Unable to open listening socket. Will not be able to communicate with Apache server.	Unable to establish connection to authentication server. Affects ability to provide internal captive portal. Could indicate problem with Apache Server instantiation. Component could be restarted to see if problem persists.	If problem persists, contact Technical Support to investigate.

Table 36: SECURITY_MANAGER (4) logs and events (Continued)

Log ID	Log Message	Comment	Action
4	Error binding to listener socket. Will not be able to communicate with Apache server.	Unable to establish connection to authentication server. Affects ability to provide internal captive portal. Could indicate problem with Apache Server instantiation. Component could be restarted to see if problem persists	If problem persists, contact Technical Support to investigate.
5	Listen call failed. Will not be able to communicate with Apache Server.	Unable to establish connection to authentication server. Affects ability to provide internal captive portal. Could indicate problem with Apache Server instantiation. Component could be restarted to see if problem persists.	If problem persists, contact Technical Support to investigate.
6	Socket call failed. Will not be able to communicate with specific component.	Internal operation failure. May affect ability to provide user authentication.	If problem persists, contact Technical Support to investigate.
Major			
9	Status thread failed to start. Will not be able to communicate with startup/ shutdown Mgr until status thread starts.		If problem persists, contact Technical Support to investigate.
13	Error occurred when sending response message to Apache server.		If problem persists, contact Technical Support to investigate.
16	Unable to create new session tracking tag (token mapping) based on MAC address. Will not be able to process Captive portal authentication request.		If problem persists, contact Technical Support to investigate.
17	Get next available session tracking tag (token) returns zero. Will not be able to process Captive portal authentication request.		If problem persists, contact Technical Support to investigate.
18	Error on deleting session tracking tag (token)%d. This will not impact success/failure of authentication request - it may create a memory leak if multiple tokens cannot be deleted.		If problem persists, contact Technical Support to investigate.

Table 36: SECURITY_MANAGER (4) logs and events (Continued)

Log ID	Log Message	Comment	Action
21	Client with MAC%s cannot be authorized on%s with filterName%s. The filterName is invalid on this%s		Validate Configuration of RadiusServer. Validate that matches WM-AD configuration. If problem persists contact Technical Support for assistance.
	Client with MAC%s cannot be authorized with filterName%s as this filterName is invalid on the%s with id%d		Validate Configuration of RadiusServer. Validate that matches WM-AD configuration. If problem persists contact Technical Support for assistance.
	Client with MAC%s cannot be authorized due to filter problems. Unable to resolve problem: failing MAC-based authorization request from client		Mapping issue for per-user radius assigned policy. User will be assigned default.
Minor			
33	Error trying to delete all session tracking tags (token mappings). As this only happens at shutdown, the memory will be released anyway.	No system impact but may indicate internal logic error in resource cleanup.	If problem persists, contact Technical Support to investigate.
34	Connect socket call failed. Will not be able to communicate with specific component.	Internal operation failure. May result in exhausting system memory resources.	If problem persists, contact Technical Support to investigate.
35	Client connected to BSSID:%s.	n/a	None
36	Client with MAC%s has failed authorization on AP <%s>.	Client on specific AP has failed authentication with controller.	Verify that user in question is properly configured to access network.
37	Client session MAC%s has failed authentication	Client on specific AP has failed authentication with controller	Verify that user in question is properly configured to access network.
Info			
65	Socket write failed. The TCP connection is down. The authentication request will fail for the session, however the secMgr will try to re-connect to the "downed" component.	Possible outage in user authentication subsystem. User will most likely re-attempt to clear situation.	If problem persists, contact Technical Support to investigate.
66	Socket read failed with errno%d. The TCP connection is down. The authentication request will fail for the session, however the secMgr will try to re-connect to the "downed" component.	Possible outage in user authentication subsystem. User will most likely re-attempt to clear situation.	If problem persists, contact Technical Support to investigate.
67	Error trying to close all sockets. However, they will time out on their own.	No negative impact to system. However indicates possible issue with resource de-allocation.	If problem persists, contact Technical Support to investigate.

Table 36: SECURITY_MANAGER (4) logs and events (Continued)

Log ID	Log Message	Comment	Action
68	Cannot connect to Radius Client. Will keep trying until connection is successful.	Inter-communications issue. Component re-attempts should restore proper link. However, if un-resolved will not allow authentication to proceed and therefore blocking any users from gaining proper access to network.	If problem persists, contact Technical Support to investigate.
69	Cannot connect to EAP. Will keep trying until connection is successful.	Inter-communications issue. Component re-attempts should restore proper link. However, if un-resolved will not allow EAP (WPA) authentication to proceed and therefore blocking any users in AAA assigned WM-ADs.	If problem persists, contact Technical Support to investigate.
70	Internal communication failure - cannot make internal data connection. Will keep trying until connection is successful.	Internal interprocess communication issue.	If problem persists, contact Technical Support to investigate.
71	Error on socket select. The socket must have already been closed.This should not impact whether an authentication request succeeds or fails for a session.	Internal interprocess communication issue.	If problem persists, contact Technical Support to investigate.
72	Error accepting new socket. Will not be able to receive login information from Apache server.	Internal interprocess communication issue. Users authenticated via internal captive portal may not reach authenticated state even with proper credentials. Component may need to be restarted.	If problem persists, contact Technical Support to investigate.
73	Error trying to send a message to Radius Client. Captive portal authentication request will fail.	Internal interprocess communication issue. Users authenticated via internal captive portal may not reach authenticated state even with proper credentials. Component may need to be restarted.	If problem persists, contact Technical Support to investigate.
74	Send SECMGR_MU_AUTHENTICATED_NOTIFY message failed for token%d	Internal interprocess communication issue. Users authenticated via internal captive portal may not reach authenticated state even with proper credentials. Component may need to be restarted.	If problem persists, contact Technical Support to investigate.
75	Received failure from Config Manager for default filter - configuration is incorrect or incomplete!	Internal configuration issue encountered. User filter policy will be applied as “Default” rather than more specific filterID indicated through radius authentication. User network access to network may be different than administration intended.	If problem persists, contact Technical Support to investigate.

Table 36: SECURITY_MANAGER (4) logs and events (Continued)

Log ID	Log Message	Comment	Action
78	Cannot find session tracking tag (token)%d. The Captive portal or MAC-based authentication request may already have been processed.	Authentication token for Captive portal received for user that is no longer listed as pending authentication. User will be redirected to internal captive portal if authentication hasn't indeed changed.	If problem persists, contact Technical Support to investigate.
79	Could not find the session information (token information) for session tracking tag (token)%d. Will not be able to process Captive portal authentication request.	Authentication token for Captive portal received for user that is no longer listed as pending authentication. User will be redirected to internal captive portal if authentication hasn't indeed changed resetting condition.	If problem persists, contact Technical Support to investigate.
80	Could not find session tracking tag (token) by MAC address. Will not be able to process Captive portal authentication request.	Authentication token for Captive portal received for user that is no longer listed as pending authentication. User will be redirected to internal captive portal if authentication hasn't indeed changed resetting condition.	If problem persists, contact Technical Support to investigate.
81	Received invalid session tracking tag (token) from Apache server. Token cannot be zero. Will not be able to process Captive portal authentication request.	Authentication token for Captive portal received for user that is no longer listed as pending authentication. User will be redirected to internal captive portal if authentication hasn't indeed changed resetting condition.	If problem persists, contact Technical Support to investigate.
82	Invalid message Id%d received from Radius Client. Authentication request for the session will fail.	Authentication response is not processed. User will re-attempt and situation shall clear itself.	If problem persists, contact Technical Support to investigate.
83	The user (with session tracking tag%d) cannot authenticate as the message to the Radius Server has timed out. Please check if configuration (especially Radius Server IP Address) is correct.	Possible problem with configuration or availability of Radius Server.	If problem persists, contact Technical Support to investigate.
84	A message has been sent to the Apache Server indicating that the authentication message for session%d to the Radius Server has timed out.	Notification to user.	None
85	The user with session tracking tag%d cannot authenticate due to an internal error in the component (Radius Client) which communicates with the Radius Server.	Possible problem with configuration or availability of Radius Server.	Validate Configuration of RadiusServer. Verify Reachability of RadiusServer utilizing the RadiusTest feature in GlobalSettings. If problem persists contact Technical Support to investigate.

Table 36: SECURITY_MANAGER (4) logs and events (Continued)

Log ID	Log Message	Comment	Action
86	The user with session tracking tag%d cannot authenticate due to a conflict in the shared secret key for the Radius Server. Please check your configuration.	Possible problem with configuration or availability of Radius Server.	Validate Configuration of RadiusServer. Verify Reachability of RadiusServer utilizing the RadiusTest feature in GlobalSettings. If problem persists contact Technical Support to investigate.
87	Client session MAC%s has been successfully authenticated.	n/a	None
88	Client with MAC%s has been successfully authorized on AP <%s>.	n/a	None
Trace			
129	Successfully created listening socket.		
130	Successfully connected to Radius Client.		
131	Successfully connected to EAP Handler.		
132	Successfully connect to CIA Agent.		
133	Successfully connected to Apache Server.		
134	Socket SETSOCKOPT error received.		
135	New log level received from Configuration Manager.		
136	Set EAP socket to %d.		
137	Set Radius Client socket to %d.		
138	Set Listening socket to %d.		
139	Set Apache socket to %d.		
140	Set CIA Agent socket to %d.		
141	Received a shutdown message from the Startup/Shutdown Mgr.		
142	Processing Apache message was unsuccessful.		
143	Processing CIA message was unsuccessful.		
144	Processing Radius Client message was unsuccessful.		
145	Processing EAP message unsuccessful.		
146	Get Next Available session tracking tag (token) %d.		

Table 36: SECURITY_MANAGER (4) logs and events (Continued)

Log ID	Log Message	Comment	Action
147	Delete session information (token mapping) for session tracking tag (token) %d.		
148	Session tracking tag (token) %d already used.		
149	Apache read bytes error with errno %d.		
150	Apache write bytes error.		
151	Apache Authentication User Request unsuccessful.		
152	Received Apache Validation Fields with session tracking tag (token) %d.		
153	Send authentication response message to Apache for token %d with status %d. The status to send was unknown, so assumed FAIL and sent that instead to Apache.		
154	Received empty login parameters from Apache Server. Either the login was empty or the password. The authentication request will fail.		
155	Send failure message to Apache regarding authentication for session tracking tag (token) %d.		
156	Send success message to Apache regarding authentication for session tracking tag (token) %d.		
157	Failed to convert MAC Hi and Low address to CHAR.		
158	Failed to convert MAC CHAR message to MAC Hi and Low.		
159	Send Radius Message with session tracking tag %d.		
160	Received Authentication success message from Radius Client for session tracking tag %d.		
161	Received Authentication failure message from Radius Client for session tracking tag (token, msgId) %d.		
162	Unknown authentication message received from Radius Client for session tracking tag %d.		

Table 36: SECURITY_MANAGER (4) logs and events (Continued)

Log ID	Log Message	Comment	Action
163	Empty login parameters to send to Radius Client for session tracking tag (token) %d.		
164	Empty MU params to send to Radius Client for session tracking tag (token) %d.		
165	Invalid msgId to send to Radius Client. Cannot send a msgId of zero as the msgId corresponds to the session tracking tag (token) which cannot be zero.		
166	Received Radius message parameters with session tracking tag (a.ka.a msgId and token) %d and filterId %d.		
167	Send Client CIA Register Request to CIA.		
168	Received CIA client Register Response from CIA.		
169	Send CIA Register Client Request to Config Manager.		
170	Not waiting for CIA Register client Response from Config Manager.		
171	Received Authentication Token request from Redirector. This is to map a session tracking tag to a MAC address.		
172	Error on receiving Authentication Token request from Redirector.		
173	Send Authentication Token response to Redirector with session tracking tag (token) %d.		
174	Error on sending Authentication Token Response to Redirector.		
175	Error reading CIA header. This error is generally caused by a component (CIA/CM) shutting down without properly closing the socket.		
176	Send MU_GET_PARAMS_REQ to MU Mgr.		
177	Error on sending MU_GET_PARAMS_REQ to MU Mgr.		
178	Received MU_GET_PARAMS response from MU Mgr.		

Table 36: SECURITY_MANAGER (4) logs and events (Continued)

Log ID	Log Message	Comment	Action
179	Error on receiving MU_GET_PARAMS response from MU Mgr.		
180	Send MU_SET_PARAMS request to MU Mgr.		
181	Error on sending MU_SET_PARAMS request to MU Mgr.		
182	Received MU_SET_PARAMS response from MU Mgr.		
183	Error on receiving MU_SET_PARAMS response from MU Mgr.		
184	Send CONFIG_POLICY request to Config Manager for session tracking tag (token) %d.		
185	Resent CONFIG_POLICY_LIST request to Config Manager for Default Filter for session tracking tag (token) %d.		
186	Error on sending CONFIG_POLICY request to Config Manager for session tracking tag (token) %d.		
187	Received Config Policy List response from Config Manager.		
188	Error on receiving Config PolicyList response from Configuration Manager.		
189	For session tracking tag (authentication token) %d, have received ingress filter Id %d and egress filter Id %d from Config Manager.		
190	Error on Radius Authentication User response for session tracking tag (token) %d.		
191	Error on processing received MU_SET_PARAMS response from MU Mgr.		
192	Received wrong number of entries for Config Policy List from Config Manager for session tracking tag (token) %d.		
193	Closed EAP Socket %d.		
194	Closed Radius Socket %d.		
195	Closed CIA socket %d.		
196	Closed Apache socket %d.		
197	Received CIA message.		
198	Received EAP message.		

Table 36: SECURITY_MANAGER (4) logs and events (Continued)

Log ID	Log Message	Comment	Action
199	Received UPDATE_LOGLEVEL_NOTIFY message from Config Manager.		
200	Error on receiving UPDATE_LOGLEVEL_NOTIFY message from Config Manager.		
201	Received UPDATE TRACE BITMASK message from Config Mgr.		
202	Error on receiving UPDATE TRACE BITMASK message from Config Manager.		
203	Error reading CIA received AUTH TOKEN REQ.		
204	Error reading CIA received MU_GET_PARAMS_RESP.		
205	Error reading CIA receive MU_SET_PARAMS_RESP.		
206	Error reading CIA received MU_CONFIG_POLICY_LIST_RESP.		
207	Error writing CIA send AUTH_TOKEN_RESP.		
208	Successfully send message response to APACHE server.		
209	Resending policy list request message to CM for child default filter.		
210	Resending policy list request message to CM for parent default filter.		
211	Cannot set login parameters for session tracking tag (token) %d. Captive portal authentication request will fail.		
212	Cannot set Apache Socket for session tracking tag (token) %d. Captive portal authentication request will fail.		
213	Cannot set policy parameters for session tracking tag (token) %d. Captive portal authentication request will fail.		
214	Cannot set MU parameters for session tracking tag (token) %d. Captive portal authentication request will fail.		
215	Apache socket is zero. Cannot send a message to the Apache Server.		
216	Radius socket is zero. Cannot send a message to Radius.		

Table 36: SECURITY_MANAGER (4) logs and events (Continued)

Log ID	Log Message	Comment	Action
217	EAP socket is zero. Cannot send a message to the EAP handler.		
218	CIA socket is zero. Cannot send a message to the IXP card.		
219	Error reading Radius Response library function.		
220	Error writing Radius Request library function for session tracking tag (token) %d.		
221	Send Radius message successful for session tracking tag (token) %d.		
222	Redirector will get session tracking tag (token) %d.		
223	Sending Authentication request message to Radius unsuccessful for session tracking tag (token) %d.		
224	Error on Authenticate User Response message to Apache for session tracking tag (token) %d.		
225	Update token %d with new wm-ad_id %d		
226	Msg Id of CIA message indicates message is not for the Security Manager. Ignore the message. This is not an error.		
227	Error on processing received MU_GET_PARAMS_RESP.		
228	Error on processing received CONFIG POLICY response from CM for session tracking tag (token) %d.		
229	Received message with unknown type		
230	Received EAP message		
231	Send authentication success message to EAP for sessionId %d		
232	Send authentication failure message to EAP for sessionId %d		
233	Send EAP Access request message for sessionId %d		
234	Error on sending EAP Access request message for sessionId %d		

Table 36: SECURITY_MANAGER (4) logs and events (Continued)

Log ID	Log Message	Comment	Action
235	Received EAP Access response message		
236	Send EAP Config Policy request for sessionId %d to CM		
237	Error on sending EAP Config Policy request for sessionId %d		
238	Received EAP Config Policy response message		
239	Resend EAP Access request message for sessionId %d		
240	MAC address %d %d %d %d %d %d already exists in session list		
241	Update sessionId %d for MAC address %d %d %d %d %d %d		
242	SessionId %d not in EAP range		
243	Error on Received EAP Access response		
244	Error on sending authentication success message to EAP for sessionId %d		
245	Error on sending authentication failure message to EAP for sessionId %d		
246	Received failure access message for EAP handler for sessionId %d		
247	Received success access message for EAP handler for sessionId %d		
248	Error on received EAP authentication request		
249	Set timeout flag for sessionId %d		
250	Clear timeout flag for sessionId %d		
251	SessionId %d timed out		
252	Received unknown status for sessionId %d so assume failure		
253	Setup EAP entry returns failure for sessionId %d		
254	Received status failed for sessionId %d regarding getting/setting MU params		

Table 36: SECURITY_MANAGER (4) logs and events (Continued)

Log ID	Log Message	Comment	Action
255	Failed to delete EAP session for sessionId %d		

RU_MANAGER (6)

Table 37: RU_MANAGER (6) logs and events

Log ID	Log Message	Comment	Action
Critical			
1	RU Manager has suffered a critical internal error and will halt (unable to start process thread).	Internal operation problem. May affect ability of APs to register with controller. Component should be restarted.	If problem persists, contact Technical Support to investigate.
2	RU Manager has suffered a critical internal error and will halt (unable to open data dictionary).	Internal operation problem. May affect ability of APs to register with controller. Component should be restarted.	If problem persists, contact Technical Support to investigate.
3	AC Manager: Moving into failover mode	Controller entering into Failover Mode. Indicates that link with peer controller has been lost. Peer controller may have shutdown or may indicate problem with interconnecting network. If Peer controller has indeed failed and network connections are intact APs will now begin failing to surviving controller.	Investigate state of peer controller. Review log entries on it to determine appropriate action.
Major			
9	An AP has attempted to connect that is unknown to the system. AP authentication failure.%s.	AP With incorrect credentials attempted to register. AP shall engage in re-discovery and re-establish proper credentials.	If problem persists contact Technical Support to investigate.
10	AP fails discovery.%s	AP has failed the discovery registration process.	If problem persists contact Technical Support to investigate.
11	Access Point failed registration: Maximum license limit of APs reached.%s	More APs than allowed by MVL attempted to register with controller. Some AP may become unable to provide RF service	Verify number of APs allowed by software licence portion of License. Contact Sales Support to discuss capacity allowance increase criteria.
12	Remote Access Point failed registration: Maximum license limit of APs reached.%s	Software licence Mismatch. More AP attempted to failover from availability peer. Recommend systems support same capacity. Some AP may become unable to provide RF service.	Verify number of APs allowed by software licence portion of License. Verify that purchase limits match on both systems. Contact Sales support to discuss allowance increases.

Table 37: RU_MANAGER (6) logs and events (Continued)

Log ID	Log Message	Comment	Action
13	Lost connectivity with Availability Peer%s.	Controller entering into Failover Mode. Indicates that link with peer controller has been lost. Peer controller may have shutdown or may indicate problem with interconnecting network. If Peer controller has indeed failed and network connections are intact APs will now begin failing to surviving controller.	Investigate state of peer controller. Review log entries on it to determine appropriate action.
Minor			
33	Internal error occurred for a single request. RU Manager will ignore the error and continue.	Failure to process AP registration request. AP will likely retry.	If problem persists contact Technical Support to investigate.
34	Challenge-response key cache is full. Until some of the existing access point's are authenticated, new registration requests will be ignored.	Temporary congestion of AP registration requests. Problem should resolve itself.	If problem persists contact Technical Support to investigate.
35	Internal error occurred for a single request. RU Manager will ignore the error and continue.	Failure to process AP registration request. AP will likely retry.	If problem persists contact Technical Support to investigate.
37	SLP registration failed. RU Manager will retry registration in 10 seconds.	Failure to register AP SLP discovery identifiers. APs may not be able to find controller. Problem should fix itself and APs will continue to retry.	If problem persists contact Technical Support to investigate.
38	AC Manager: Unauthorized client%s attempting to connect.	Unregistered Peer attempting to establish an availability pair. Possible misconfiguration in Availability pairings.	Verify Availability pairing configuration in both controllers. If indeed configuration is correct, contact Technical Support to investigate.
39	AC manager: Unable to set foreign ports in database.	Possible failure to update availability pair configuration. May affect APs ability to failover properly and expediently.	If problem persists contact Technical Support to investigate.
40	AC manager: Unable to set foreign APs in database.	Possible failure to register Failed over APs. May affect software licensing and AP registration.	If problem persists contact Technical Support to investigate.
41	AC Manager: Unable to update foreign APs in database.	"Availability"	If problem persists contact Technical Support to investigate.
42	Access point%s attempting to connect but maximum licensed connections reached.	Licensed software licence reached. Additional APs may not become Active therefore affecting intended coverage area.	Validate License Key parameters. Contact Sales Support to discuss options on capacity increase.

Table 37: RU_MANAGER (6) logs and events (Continued)

Log ID	Log Message	Comment	Action
Info			
65	AP registered.%s	AP Identified by Serial Number has registered.	None
66	AP authenticated.%s	AP Identified by Serial Number has registered.	None
67	RU Manager started normally.	Component state.	None
68	RU Manager shutting down normally.	Component state.	None
69	SLP registration successful.	Component state.	None
71	AC Manager: Recovering from failover to normal mode	Availability pairing restored.	None
72	AP connects for registration.%s	AP registration.	None
73	AP connects for discovery.%s	AP registration.	None
74	AC Manager Configuration:%s	Info. Availability Pairing configuration.	None
75	Could not add foreign AP to database. Perhaps it already exists as a local AP. Serial number is%s.	Possible conflict with AP configuration record.	If problem persists contact Technical Support to investigate.
76	Licensed maximum AP registrations exceeded, authentication fails:%s.	Licensed software licence reached. Additional APs may not become Active therefore affecting intended coverage area.	Validate License Key parameters. Contact Sales Support to discuss options on capacity increase.
77	Unable to add foreign AP, license limit exceeded.	Licensed software licence reached. Additional APs may not become Active therefore affecting intended coverage area. Ensure failover capacity matches between the two controllers.	Licensed software licence reached. Additional APs may not become Active therefore affecting intended coverage area.
78	Availability Link established with Peer%s.	Info. Availability pairing restored.	None
Trace			
129	RU Manager TRACE: %s		

RADIUS_CLIENT (7)

Table 38: RADIUS_CLIENT (7) logs and events

Log ID	Log Message	Comment	Action
Critical			
1	A file system error occurred. Unable to open RADIUS dictionary file. RADIUS client exiting.	Possible initialization problem for RadiusClient component. May affect ability of users to authenticate with system and therefore affect their ability to gain network access.	If problem persists contact Technical Support to investigate.
2	Cannot allocate memory for either Captive Portal and/or EAP modules. RADIUS client exiting.	Possible resource utilization with system. May affect ability of users to authenticate with system and therefore affect their ability to gain network access. Component may need to be restarted to resolve issue, or may indicate larger problem with system's resource utilization.	If problem persists contact Technical Support to investigate.
3	Failed to send process status success to Startup Manager. Start-up Manager will reboot the RADIUS client.	Component may be restarted by system health monitoring facility. May cause temporary outage to authentication sub-system. Issue should self resolve after reset.	If problem persists contact Technical Support to investigate.
4	No radius server available for subnet:%s.	Possible problem with configuration or availability of Radius Server. Users may be unable to gain proper network access.	Validate Configuration of RadiusServer. Verify Reachability of RadiusServer utilizing the RadiusTest feature in GlobalSettings. If problem persists contact Technical Support to investigate.
Major			
9	Failed to retrieve configuration from the Config Manager. Will retry connection to Config Manager.	Possible problem with configuration of authentication sub-system, in particular may become unable to determine correct Radius Configuration. Connection retry should resolve condition.	If problem persists contact Technical Support to investigate.
10	Radius server changed:%s	Configuration of RadiusServer changed by administration.	None
11	Failed to get radius profile for subnet:%s.	Possible problem with configuration or availability of Radius Server. Users may be unable to gain proper network access.	Validate Configuration of RadiusServer in GlobalSettings and in WM-AD definition. Verify Reachability of RadiusServer utilizing the RadiusTest feature in GlobalSettings. If problem persists contact Technical Support to investigate.

Table 38: RADIUS_CLIENT (7) logs and events (Continued)

Log ID	Log Message	Comment	Action
Minor			
33	Config Manager returned wrong flag. Will retry retrieving configuration.	Possible problem with configuration of authentication sub-system, in particular may become unable to determine correct Radius Configuration. Connection retry should resolve condition.	If problem persists contact Technical Support to investigate.
34	Internal error occurred for a single request. RADIUS client will ignore the error and continue.	Possible issue with configuration of authentication sub-system. User should re-attempt the registration thus resolving issue.	If problem persists contact Technical Support to investigate.
35	Invalid radius server IP. Subnet%d is not available.	Possible problem with configuration or availability of Radius Server. Users may be unable to gain proper network access.	Validate Configuration of RadiusServer in GlobalSettings and in WM-AD definition. Verify Reachability of RadiusServer utilizing the RadiusTest feature in GlobalSettings. If problem persists contact Technical Support to investigate.
36	Invalid NAS IP. Subnet%d is not available.	Possible problem with configuration or availability of Radius Server. Users may be unable to gain proper network access.	Validate Configuration of RadiusServer in GlobalSettings and in WM-AD definition. Verify Reachability of RadiusServer utilizing the RadiusTest feature in GlobalSettings. If problem persists contact Technical Support to investigate.
37	Invalid retry count for subnet%d. Default value will be used.	Possible problem with configuration or availability of Radius Server or WM-AD configuration of radius parameters. Default parameters will be used. No expected impact to user authentication.	Validate Configuration of RadiusServer in GlobalSettings and in WM-AD definition. Verify Reachability of RadiusServer utilizing the RadiusTest feature in GlobalSettings. If problem persists contact Technical Support to investigate.
38	Invalid timeout setting for subnet%d. Default value will be used.	Possible problem with configuration or availability of Radius Server or WM-AD configuration of radius parameters. Default parameters will be used. No expected impact to user authentication.	Validate Configuration of RadiusServer in GlobalSettings and in WM-AD definition. Verify Reachability of RadiusServer utilizing the RadiusTest feature in GlobalSettings. If problem persists contact Technical Support to investigate.

Table 38: RADIUS_CLIENT (7) logs and events (Continued)

Log ID	Log Message	Comment	Action
39	Invalid radius server port number for subnet%d. Default value will be used.	Possible problem with configuration or availability of Radius Server or WM-AD configuration of radius parameters. Default parameters will be used. If default value doesn't provide reachability of RadiusServer, users may be unable to authenticate.	Validate Configuration of RadiusServer in GlobalSettings and in WM-AD definition. Verify Reachability of RadiusServer utilizing the RadiusTest feature in GlobalSettings. If problem persists contact Technical Support to investigate.
40	Invalid NAS port number for subnet%d. Default value will be used.	Possible problem with configuration or availability of Radius Server or WM-AD configuration of radius parameters. Default parameters will be used. No expected impact to user authentication.	Validate Configuration of RadiusServer in GlobalSettings and in WM-AD definition. Verify Reachability of RadiusServer utilizing the RadiusTest feature in GlobalSettings. If problem persists contact Technical Support to investigate.
41	Mismatched IP addresses:%s	Possible problem with configuration or availability of Radius Server or WM-AD configuration of radius parameters. Default parameters will be used. No expected impact to user authentication.	Validate Configuration of RadiusServer in GlobalSettings and in WM-AD definition. Verify Reachability of RadiusServer utilizing the RadiusTest feature in GlobalSettings. If problem persists contact Technical Support to investigate.
42	WPA2 pre-authentication failure.%s.	User failed authentication.	Validate user credentials configuration. If problem persist with proper user configuration contact Technical Support to investigate
Info			
65	RADIUS server authenticated login (Access Accepted).	User authentication successful	None
66	RADIUS server rejected login (Access Rejected).	User failed authentication	Validate user credentials configuration. If problem persist with proper user configuration contact Technical Support to investigate.
67	Radius Request: %s	Radius Authentication State	None
68	Radius Response: %s	Radius Authentication State	None
69	WPA2 pre-authentication success. %s.	Radius Authentication State	None
Trace			
129	Sent RADC_WM-AD_CONFIG_REQ.		
130	Received message from CM: cia_type %d, type %d.		
131	Got CP_Entry[%d]:wm-ad_id:%d,flags:%d,radius_svr_ip:%d,rad_svr_port:%d,nas_ip:%d,nas_port:%d,authtype:%d		

Table 38: RADIUS_CLIENT (7) logs and events (Continued)

Log ID	Log Message	Comment	Action
132	Got EAP_Entry:[%d]:wm-ad_id:%d,flags:%d,rad_srv_ip:%d,rad_srv_port:%d,retrycount:%d,timeout:%d		
133	got entry:NONE_CONFIG:[%d]:wm-ad_id:%d, flags:%d.		
134	Radius Request Debug: %s		
135	Radius Response Debug: %s		
136	%s		
238	RADIUS CLIENT SEND: %s		
239	RADIUS CLIENT RECEIVE: %s		

HOST_SERVICE_MANAGER (8)

Table 39: HOST_SERVICE_MANAGER (8) logs and events

Log ID	Log Message	Comment	Action
Critical			
1	Failed to set management IP address ' + newData[1] + '. Please check your network for probable conflict. Rolling back to IP address ' + currentData[1] + '.'	Possible network conflict for system IP address. Configuration request failed.	Verify network topology and addressing.

VNMGR (9)

Table 40: VNMGR (9) logs and events

Log ID	Log Message	Comment	Action
Critical			
1	Critical internal error - memory protection flags have been corrupted. Mobility Manager will halt.	Internal operation problem. May affect Mobility Domain state. Component will be restarted automatically.	If problem persists contact Technical Support to investigate.
2	Internal system interrupt handlers failed to initialize. Mobility Manager will halt.	Internal operation problem. May affect Mobility Domain state. Component will be restarted automatically.	If problem persists contact Technical Support to investigate.
3	Unable to initialize internal program thread. Mobility Manager will halt.	Internal operation problem. May affect Mobility Domain state. Component will be restarted automatically.	If problem persists contact Technical Support to investigate.

Table 40: VNMGR (9) logs and events (Continued)

Log ID	Log Message	Comment	Action
4	Critical internal error - unable to allocate memory for Mobility Manager. Mobility Manager will halt.	Internal operation problem. May affect Mobility Domain state. Component will be restarted automatically. However, failure condition may indicate larger issue with memory resource utilization in the system.	If problem persists contact Technical Support to investigate.
5	Socket call failed. Will not be able to communicate with specific component.	Internal operation issue. May affect Mobility domain state. Component will be restarted automatically.	If problem persists contact Technical Support to investigate.
6	Unable to initialize internal program data structure. Mobility Manager will halt.	Internal operation issue. May affect Mobility domain state. Component will be restarted automatically.	If problem persists contact Technical Support to investigate.
7	Unable to determine configuration: exiting serverthread.	Possible problem with configuration of Mobility feature component subset. Inter-Controller Mobility functionality may not be functional	If problem persists contact Technical Support to investigate.
	Unable to update configuration: exiting serverthread	Possible problem with configuration of Mobility feature component subset. Possibly Minor impact on Inter-Controller feature	If problem persists contact Technical Support to investigate.
	Unable to update main AC List with own information: exiting serverthread	Internal operation issue. May affect Mobility domain state. Component may need to be reset.	If problem persists contact Technical Support to investigate.
	Unable to update tunnel list with own information: exiting serverthread	Internal operation issue. May affect Mobility domain feature state. Component may need to be reset.	If problem persists contact Technical Support to investigate.
	Malloc failed	Internal operation problem. May affect Mobility Domain state. Component will be restarted automatically. However, failure condition may indicate larger issue with memory resource utilization in the system.	If problem persists contact Technical Support to investigate.
Major			
9	Configuration error - missing or bad parameters. Mobility Manager will retry configuration request. Mobility Manager will not start-up until configuration is successful.	Possible problem with configuration of Mobility feature component subset. Inter-Controller Mobility functionality may not be functional	Verify Mobility Feature configuration. Contact Technical Support for investigation
10	Set Configuration data failed. The Mobility Manager may be restarted.	Possible problem with configuration of Mobility feature component subset. Possibly Minor impact on Inter-Controller feature.	If problem persists contact Technical Support to investigate.

Table 40: VNMGR (9) logs and events (Continued)

Log ID	Log Message	Comment	Action
11	Get Configuration data failed. The Mobility Manager may be restarted.	Possible problem with configuration of Mobility feature component subset. Possibly Minor impact on Inter-Controller feature.	If problem persists contact Technical Support to investigate.
12	Internal status changed. Mobility Manager will shutdown and be re-started by the Start-up Manager.	Role change by Administrator.	None
13	Mobility Manager has received incomplete filterId information for the client with MAC%s. This client will be treated as experiencing an authorization error.	MAC based authentication. User will be disconnected and forced to re-authenticate with system	If problem persists contact Technical Support to investigate.
	Mobility Manager has received invalid authentication information for the client with MAC%s. This client will be treated as experiencing an authorization error.	MAC based authentication. User will be disconnected and forced to re-authenticate with system	If problem persists contact Technical Support to investigate.
14	Received unknown message type%d from Langley (CM socket).	Internal processing issue. Unrecognized command. Should have no impact on system or inter-controller mobility operation.	If problem persists contact Technical Support to investigate.
15	Heart-beat interval has expired - have missed too many heart-beats from Mobility Manager. Mobility Agent will reset all remote client information and revert to nodal operation.	Agent-Controller link has expired. Controller reverts to nodal state. Users roaming in/out of controller will need to re-establish new sessions, require re-authentication and topology update.	Validate state of peer controllers. Analyze logs on controllers to determine appropriate action.
16	Update interval has expired for Mobility Agent with IP address%s. Mobility Manager will remove all information for Mobility Agent including client session information.	Agent-Controller link has expired. Controller reverts to nodal state. Users roaming in/out of controller will need to re-establish new sessions, require re-authentication and topology update.	Validate state of peer controllers. Analyze logs on controllers to determine appropriate action.
17	Mobility Control connection attempted by unrecognized peer%s. Peer will not be allowed to connect.	Mobility membership in protected mode.	Administrator must approve new system to grant access to Mobility domain.
18	Connection identifiers for Mobility establishment exhausted. Please remove stale identifiers from permissions list.	Maximum number of peers in mobility domain (127) reached. New controllers will not be allowed to join mobility domain.	Administrator should clean up stale registered mobility domain elements.
19	Agent has been informed that all connection identifiers for Mobility establishment exhausted. Please remove stale identifiers from permissions list on manager.	Maximum number of peers in mobility domain (127) reached. New controllers will not be allowed to join mobility domain.	Administrator should clean up stale registered mobility domain elements.

Table 40: VNMGR (9) logs and events (Continued)

Log ID	Log Message	Comment	Action
20	Establishment of control tunnel with Mobility Manager failed. Please verify Mobility configuration for both Agent and target Manager.	Possible problem with configuration of Mobility feature component subset. Inter-Controller Mobility functionality may not be functional.	Verify Mobility Feature configuration. If problem persists Contact Technical Support for investigation.
Minor			
33	Client%s.	Mobility Peer Identification	None
34	Client%s.	Mobility Peer Identification	None
35	Mobility Manager failed to received response for MAC-based authorization for client with MAC%s.	MAC based authentication. User will be disconnected and forced to re-authenticate with system.	If problem persists Contact Technical Support for investigation.
36	Connection established with:%s	Mobility Peer Identification	None
Info			
65	Mobility Manager shutting down normally.	Administrator requested system termination. System will shutdown. Mobility Domain will be terminated.	None
66	Mobility Manager sending a disconnect message to all neighbors.	Mobility Manager has determined that Mobility Domain should be terminated. Typical for role changing and shutdown conditions.	None
67	Mobility Manager was unable to de-register the SLP service registration. SLP Directory Agent may report an out-of-date service registration.	Possible issue with inter-AC discovery.	If problem persists Contact Technical Support for investigation.
68	Sending a disconnect message to the Mobility Manager.	Client determines need to disconnect from mobility domain.	None
69	Mobility Manager has been unable to register itself as a service with slpd.	Possible issue for inter-AC discovery. Component will retry.	If problem persists Contact Technical Support for investigation.
70	Timeout occurred for configuration message. Error will be ignored and another configuration message resent.	Mobility subsystem initialization problem. Component will retry.	If problem persists Contact Technical Support for investigation.
71	Configuration change successful.	Record change to configuration parameters	None
72	Sending disconnect to neighbor with IP address%s.	Mobility State management	None
73	Sending configuration change to neighbor with IP address%s.	Mobility State management	None
74	Mobility Agent disconnected from the Mobility Manager. Agent will attempt to reconnect with the Mobility Manager.	Mobility State management	None

Table 40: VNMGR (9) logs and events (Continued)

Log ID	Log Message	Comment	Action
76	Mobility Agent has found a Mobility Manager at IP address%s.	Mobility State management	None
77	Communication heart-beat interval changed to%d.	Mobility Configuration management. Administrator change.	None
78	Default communication heart-beat time changed.	Mobility Configuration management. Administrator change.	None
79	Slpd service or attribute change successful.	Mobility Configuration management. Administrator change.	None
80	Configuration change successful.	Mobility Configuration management. Administrator change.	None
81	Two or more ACs are proclaiming that they are the home for an MU with the MAC address%s. The Mobility Manager will be informed and will resolve this conflict.	Conflict Resolution. User will be disconnected from Mobility domain to force proper re-authentication at point-of-presence.	None
82	MU information may have changed or MU may have roamed.%s.	Mobility State management	None
83	Successful MAC authorization for client%s.	MAC Auth State	None
84	The Access Controller ID in the client registration message is empty. Other AC's will not be notified about this client.	n/a	n/a
85	Connection with Mobility Manager not successful with Version 2. Reattempting with Version 1.	Backwards compatibility. V4.x Controller attempting to register with V1.x.	None
Trace			
129	Successfully sent AC_ID %d to IXP		
130	Open pipe for fd %d		
131	Exit serverthread		
132	Disconnect message received for thread with fd %d		
133	Set CIA socket to %d		
134	Close CIA socket		
135	My ip address is %s		
136	My ixp ip address is %s		
137	Read VN packet hdr with %s.		
138	Write VN packet hdr with %s.		
139	Read VN packet with ac_num %d, mu_num %d, and tunnel_num %d		

Table 40: VNMGR (9) logs and events (Continued)

Log ID	Log Message	Comment	Action
140	Write VN packet with ac_num %d, mu_num %d, and tunnel_num %d		
141	Read VN_Conn_establish payload with hb_int %d and agent_ac_id %d		
142	Write VN_Conn_establish payload with hb_int %d and agent_ac_id %d		
143	Read VN disconnect payload with errCode %d and subErrCode %d		
144	Write VN disconnect payload with errCode %d and subErrCode %d		
145	Connected to VN Mgr at %s.		
146	Received bad CIA message		
147	Send CIA Subscribe message		
148	Send request to CM to get VNMGR configuration		
149	Received response from CM for VNMGR configuration		
150	Received request from CM to change VNMGR configuration		
151	Send acknowledgement to VNMGR for changing VNMGR configuration		
152	Send CIA_IXP_MU_DEREGISTER_REQ message		
153	Send CIA_IXP_AC_INIT message		
154	Send CIA_AC_TUNNEL_REGISTER_REQ message		
155	Send CIA_AC_TUNNEL_DEREGISTER_REQ message		
156	Received CIA_AC_TUNNEL_REGISTER_RESP message		
157	Received CIA_AC_TUNNEL_DEREGISTER_RESP message		
158	Send CIA_IXP_MU_REGISTER_PARAMS_RESP message		
159	Received CIA_IXP_MU_REGISTER_PARAMS_REQ message		

Table 40: VNMGR (9) logs and events (Continued)

Log ID	Log Message	Comment	Action
160	Received CIA_IXP_MU_STATE_NOTIFY message for MU with %s.		
161	Received CIA_IXP_MU_STATS_NOTIFY message		
162	Received CIA_MU_DEREGISTER_NOTIFY message for MU with MAC %s.		
163	Received unknown CIA message with messageType %d		
164	Update main MU List with %s.		
165	Cleanup MU list		
166	Update main AC list with %s		
167	Update AC neighbor list with %s.		
168	Add or delete tunnel with %s.		
169	Cleanup tunnel entry with ac_id %d		
170	Set all tunnels to disconnected		
171	Add or update total tunnel list with %s.		
172	Delete total tunnel entries based on ac_id %d		
173	Delete all total tunnel entries		
174	Cleanup all extinct tunnels and total tunnels		
175	Generating new ac_id %d		
176	Release ac_id %d		
177	CIA socket is zero		
178	AC has run out of ac_ids it can generate		
179	Received ES_LOG_LVL_UPDATE message from CM		
180	Suppress heartbeat		
181	Unsuppress heartbeat		
182	Unable to match access controller information %d to data supplied for client.		
183	Received shutdown request directed to vnMgr.		
184	%s.		
185	Mobility Manager slpd registration successful for IP address %s.		

STACK_ADAPTER (10)

Table 41: STACK_ADAPTER (10) logs and events

Log ID	Log Message	Comment	Action
Info			
65	Fast Ethernet Stack Adaptor Started.	System initialization state	None
66	Gigabit Ethernet Stack Adapter Started.	System initialization state	None
Trace			
129	Received SIGHUP.		
130	Received SIGINT.		
131	CPDP Process Error %d.		
132	Port %d Added.		
133	Port %d Removed.		
134	Port %d Enabled.		
135	Port %d Disabled.		

CLI (11)

Table 42: CLI (11) logs and events

Log ID	Log Message	Comment	Action
Major			
9	Upgrade process failed - failure reason:%s.	System application/firmware upgrade process failed. System operating components and personality may be lost as a result.	If problem persists Contact Technical Support for investigation.
10	System restore process failed - failure reason:%s.	Database restore procedure failed. System configuration may not be up to level customer intends.	If problem persists Contact Technical Support for investigation.
11	Patch installation failed - failure reason:%s.	System update failed. System software base may not be fully installed and may result in subsequent failures of operations.	If problem persists Contact Technical Support for investigation.
12	Process%s killed by restart CLI command.	n/a	n/a
Minor			
33	FTP for%s failed. Back-up process failed	FTP operation failed. Revisit operation parameters.	If problem persists Contact Technical Support for investigation.

Table 42: CLI (11) logs and events (Continued)

Log ID	Log Message	Comment	Action
34	failure reason:%s.	Database backup procedure failed. Revisit operation parameters and storage availability.	If problem persists Contact Technical Support for investigation.
Info			
65	FTP for%s started.	FTP operation state	None
66	FTP for%s successful.	FTP operation state	None
67	Back-up process started.	Backup Procedure state	None
68	Back-up process successful.	Backup Procedure state	None
69	Upgrade process started.	Backup Procedure state	None
70	Upgrade process successful.	Upgrade Procedure state	None
71	System restore process started.	Restore Procedure state	None
72	System restore process successful.	Restore Procedure state	None
73	Upgrade in progress. System reboot started.	System shutdown due to upgrade process requested by Admin.	None
74	System reboot requested.	System Shutdown requested by Admin	None
75	System halt requested.	System Shutdown requested by Admin	None
76	Patch installation started.	System Software Maintenance State	None
77	Patch installation successful.	System Software Maintenance State	None

LANGLEY (13)

Table 43: LANGLEY (13) logs and events

Log ID	Log Message	Comment	Action
Critical			
1	Langley has suffered a critical error, and has halted. Error Details:%s	Internal communications issue. Possible interruption in inter-process communication.	If problem persists Contact Technical Support for investigation.
Major			
9	Langley has experienced an error which has prevented it from properly processing a request. Langley will continue running, however this error may be an indicator of a larger system problem. Error Details:%s	Internal communications issue. Possible interruption in inter-process communication.	If problem persists Contact Technical Support for investigation.

Table 43: LANGLEY (13) logs and events (Continued)

Log ID	Log Message	Comment	Action
10	A connection request from '%s' failed to authenticate with the messaging server. This may indicate that somebody is port-scanning the access controller, or is attempting to gain backdoor access.	Possible Denial of Service attack.	Verify credentials of source. If problem persists and problem is deemed to be associated with internal component, contact Technical Support to investigate.
Minor			
33	Langley has failed to process a request. Langley is still running, and system functionality is not impaired. Error Details:%s	Internal communications issue.Minor interruption in inter-process communication.	If problem persists Contact Technical Support for investigation.
Info			
65	Shutdown sequence initiated.	Administrator requested system shutdown.	None
66	Shutting down.	Administrator requested system shutdown.	None
67	Timeout receiving message from component%d on fd%d. Connection closed.	Internal communications issue. Possible interruption in inter-process communication.	If problem persists Contact Technical Support for investigation.
Trace			
129	%s		
130	CIA message received: %s		
131	%s		

NSM_SERVER (15)

Table 44: NSM_SERVER (15) logs and events

Log ID	Log Message	Comment	Action
Major			
9	NSM suffered an internal connection failure. Re-trying connection.	Internal operation issue. Retrial should resolve issue.	If problem persists Contact Technical Support for investigation.
10	NSM suffered an internal messaging failure. Re-trying connection.	Internal operation issue: Retrial should resolve issue.	If problem persists Contact Technical Support for investigation.
11	Can not set MTU for interface%s.	Possible configuration problem. May affect system ability to communicate properly with its network peers.	If problem persists Contact Technical Support for investigation.

Table 44: NSM_SERVER (15) logs and events (Continued)

Log ID	Log Message	Comment	Action
Minor			
33	Unknown internal program message received - type%d. Message will be ignored and processing continued.	Internal communications issue. No direct impact to system operation, however may be symptom of more serious condition.	If problem persists Contact Technical Support for investigation.
Info			
65	NSM started normally.	Component state	None
67	Static route deleted successfully.	Route configuration state	None
68	Get static routes successful.	Route configuration state	None
Trace			
129	Connected to Langley		
130	CIA Connection restarted		
131	Add static route request		
132	Delete static route request		
133	Get static routes request		
134	Get all routes request		
135	Get all routes successful.		
136	Static route added successfully.		

OSPF_SERVER (17)

Table 45: OSPF_SERVER (17) logs and events

Log ID	Log Message	Comment	Action
Major			
9	OSPF server suffered an internal messaging failure. Re-trying connection.	OSPF restart purges routing table resulting in temporary outage of routing topology. APs may disconnect from controller affecting wireless domain. Retrial shall restore routing state.	If problem persists Contact Technical Support for investigation.
Minor			
33	Unknown internal program message received - type%d. Message will be ignored and processing continued.	Internal communications issue. No direct impact to system operation, however may be symptom of more serious condition.	If problem persists Contact Technical Support for investigation.
Info			
65	NSM started normally.	Component state	None
66	Static route deleted successfully.	Component state	None

Table 45: OSPF_SERVER (17) logs and events (Continued)

Log ID	Log Message	Comment	Action
67	Get static routes successful.	Component state	None
68	Delete OSPF interface successful.	Component state	None
69	Retrieving OSPF configuration successful.	Component state	None
70	Retrieving OSPF interface information successful.	Component state	None
Trace			
129	Connected to Langley		
130	CIA Connection restarted		
131	Configure OSPF protocol request		
132	Add OSPF interface request		
133	Delete OSPF interface request		
134	Get OSPF configuration request		
135	Get OSPF interfaces request		
136	Get OSPF neighbors request		
137	Get OSPF Link State database request.		
138	Retrieving OSPF neighbors information successful.		
139	Retrieving OSPF database information successful.		

CDR_COLLECTOR (23)

Table 46: CDR_COLLECTOR (23) logs and events

Log ID	Log Message	Comment	Action
Critical			
1	CDR Manager failed to open accounting file for writing. The CDR Manager will halt.	Possible impact to user accounting and billing. Situation should repair following component restart.	If problem persists Contact Technical Support for investigation.
2	Memory allocation failure - unable to generate accounting record. CDR Manager will halt.	Possible impact to user accounting and billing. Situation should repair following component restart. However condition may be result of larger issue with memory resource utilization.	If problem persists Contact Technical Support for investigation.

Table 46: CDR_COLLECTOR (23) logs and events (Continued)

Log ID	Log Message	Comment	Action
3	File storage limit has been reached for the accounting files. The oldest file(s) will be deleted to free up room for the new accounting files.	CDRs will be truncated to create room for new records.	Customer should retrieve CDRs more frequently and clear old files.
8	CDR critical:%s.	n/a	n/a
Major			
9	Internal messaging error:%d. Accounting information for one client session will be incomplete.	Internal operation error. Specific CDR record may not be consistent.	If problem persists Contact Technical Support for investigation.
11	Can not create new CDR record for session%d. Accounting record for one client session will be unavailable.	Internal operation error. Specific CDR record may not be consistent.	If problem persists Contact Technical Support for investigation.
12	Internal messaging error:%d. Error will be ignored and message re-tried.	Internal operation error. Specific CDR record may not be consistent.	If problem persists Contact Technical Support for investigation.
13	Internal messaging error:%d. Error will be ignored and message re-tried.	Internal operation error. Specific CDR record may not be consistent.	If problem persists Contact Technical Support for investigation.
14	CDR Manager failed when attempting to write client record to accounting file. Accounting record for this client session will be unavailable.	Internal operation error. Specific CDR record may not be consistent.	If problem persists Contact Technical Support for investigation.
15	Internal messaging error - more accounting records were received than expected. Known sessions will be processed; unknown information will be dropped.	Internal operation error. Specific CDR record may not be consistent.	If problem persists Contact Technical Support for investigation.
32	CDR major:%s.	n/a	n/a
Minor			
33	Unable to add binary property to internal message payload [%d]. Error will be ignored and processing continued.	Internal operation error. Specific CDR record may not be consistent.	If problem persists Contact Technical Support for investigation.
34	Unable to add integer property to internal message payload [%d]. Error will be ignored and processing continued.	Internal operation error. Specific CDR record may not be consistent.	If problem persists Contact Technical Support for investigation.
35	Unable to add string property to internal message payload [%d]. Error will be ignored and processing continued.	Internal operation error. Specific CDR record may not be consistent.	If problem persists Contact Technical Support for investigation.
36	Unable to add array property to internal message payload [%d]. Error will be ignored and processing continued.	Internal operation error. Specific CDR record may not be consistent.	If problem persists Contact Technical Support for investigation.

Table 46: CDR_COLLECTOR (23) logs and events (Continued)

Log ID	Log Message	Comment	Action
37	Unable to read binary property from internal message payload [%d]. Error will be ignored and processing continued.	Internal operation error. Specific CDR record may not be consistent.	If problem persists Contact Technical Support for investigation.
38	Unable to read integer property from internal message payload [%d]. Error will be ignored and processing continued.	Internal operation error. Specific CDR record may not be consistent.	If problem persists Contact Technical Support for investigation.
39	Unable to read string property from internal message payload [%d]. Error will be ignored and processing continued.	Internal operation error. Specific CDR record may not be consistent.	If problem persists Contact Technical Support for investigation.
40	Unable to read array property from internal message payload [%d]. Error will be ignored and processing continued.	Internal operation error. Specific CDR record may not be consistent.	If problem persists Contact Technical Support for investigation.
41	Client statistics message failed to be logged to accounting record. Record may be incomplete for client session.	Internal operation error. Specific CDR record may not be consistent.	If problem persists Contact Technical Support for investigation.
42	Client authentication message failed to be logged to accounting record. Record will be incomplete for client session.	Internal operation error. Specific CDR record may not be consistent.	If problem persists Contact Technical Support for investigation.
43	Client status change message failed to be logged to accounting record. Record will be incomplete for client session.	Internal operation error. Specific CDR record may not be consistent.	If problem persists Contact Technical Support for investigation.
44	Client de-registration message failed to be logged to accounting record. Record will be incomplete for client session.	Internal operation error. Specific CDR record may not be consistent.	If problem persists Contact Technical Support for investigation.
45	CDR record to update [%d] does not exist. Error will be ignored and processing continued.	Internal operation error. Specific CDR record may not be consistent.	If problem persists Contact Technical Support for investigation.
46	Wrong length of binary data received [%d] [len=%d]. Error will be ignored and processing continued.	Internal operation error. Specific CDR record may not be consistent.	If problem persists Contact Technical Support for investigation.
47	Can not free memory used for storing client accounting record. A memory leak is occurring. CDR Manager will continue processing.	Internal operation error. Specific CDR record may not be consistent. However condition may indicate more serious condition with system memory resource management.	If problem persists Contact Technical Support for investigation.
64	CDR minor:%s.	n/a	n/a
	Unable to subscribe messages.	Internal operation error. Specific CDR record may not be consistent.	If problem persists Contact Technical Support for investigation.

Table 46: CDR_COLLECTOR (23) logs and events (Continued)

Log ID	Log Message	Comment	Action
	Fail to receive cdr_config_notify.	Possible issue with configuration of CDR/ Accounting sub-system. Can result in lack of accounting reporting/CDR for system users. Doesn't affect users state, however, it doesn't allow owner to provide proper billing for services rendered.	Validate configuration of CDR/ Accounting settings for Radius Server and WM-AD definitions. If problem persists contact Technical Support to investigate.
	Fail to receive stats bundle notify.	Internal operation error.One update snapshot is missed. Possible impact to CDR/ Accounting state. Subsequent updates should remedy the situation.	If problem persists Contact Technical Support for investigation.
	Fail to receive authenticated userid from security manager.	Internal operation error. Specific CDR record may not be consistent. Tracking CDR is harder without username property.	If problem persists Contact Technical Support for investigation.
	Client MAC:%s User-ID:%s: has invalid IP address [0.0.0.0]. Failed to create CDR.	User records are not tracked until user obtains proper IP address. Verify that users are able to obtain proper addresses from WM-AD.	If problem persists Contact Technical Support for investigation.
	Fail to receive message get_params_resp:%d	Internal operation error. Specific CDR record may not be consistent.	If problem persists Contact Technical Support for investigation.
	Fail to receive message mu_deregister_notify:%d	Internal operation issue. Specific CDR may not be consistent. User termination time may not be properly adjusted.	If problem persists Contact Technical Support for investigation.
	Fail to receive message smt_shutdown_component_req: %d	System shutdown operation under admin control (enable/ disable feature, system shutdown).	If problem persists Contact Technical Support for investigation.
	Fail to receive message es_log_lvl_update_notify:%d	Internal communications issue. Unable to determine proper logging level for component.	If problem persists Contact Technical Support for investigation.
Info			
65	New CDR file has been created.	Accounting state	If problem persists Contact Technical Support for investigation.
66	Created a new CDR record with session id%d.	Accounting state	If problem persists Contact Technical Support for investigation.
67	CDR record was written to file with session id%d.	Accounting state	If problem persists Contact Technical Support for investigation.
68	CDR Manager started normally.	Accounting sub-system state	If problem persists Contact Technical Support for investigation.

Table 46: CDR_COLLECTOR (23) logs and events (Continued)

Log ID	Log Message	Comment	Action
69	All CDR records written to file. Shutting down normally.	Accounting sub-system state	If problem persists Contact Technical Support for investigation.
70	The old CDR directory has been removed.	Accounting sub-system state	If problem persists Contact Technical Support for investigation.
128	CDR informational:%s.	n/a	n/a
Trace			
129	Received IXP_MU_STATE_NOTIFY message.		
130	Received IXP_MU_DEREGISTER_NOTIFY message.		
131	Received IXP_MU_STATS_NOTIFY message.		
132	Received SECMGR_MU_AUTHENTICATED_NOTIFY message.		
133	Received IXP_MU_GET_PARAMS_RESP message.		
134	Sent IXP_MU_GET_PARAMS_REQ message		
135	Received SMT_SHUTDONW_COMPONENT_REQ message		
136	Sent SMT_SHUTDONW_COMPONENT_RESP message.		
137	Received ES_LOG_LVL_UPDATE_NOTIFY message.		
138	Received and dropped an unexpected message.		
256	%s		

RF_DATA_COLLECTOR (36)

Table 47: RF_DATA_COLLECTOR (36) logs and events

Log ID	Log Message	Comment	Action
Critical			
1	An error has occurred in the RF Data Collector which will cause this component to shutdown (and be restarted by the system). Details:%s.	Internal operation error. Rogue AP scan updates may be temporarily suspended. Should resume once component is automatically restarted by the system's health monitor.	If problem persists Contact Technical Support for investigation.
Major			
9	An error has occurred in the RF Data Collector. This error will be ignored and the component will attempt to continue. Details:%s.	Internal operation error. Relay of Rogue AP scan updates may be temporarily suspended.	If problem persists Contact Technical Support for investigation.
Minor			
33	An error has occurred in the RF Data Collector which will not interfere with system processing. This error will be ignored and processing continued. Details:%s.	Internal operation error. Relay of Rogue AP scan updates may be temporarily suspended.	If problem persists Contact Technical Support for investigation.
Info			
65	Received scan request with req_id of zero	Possible operational error for Summit WM series Spy feature.	If problem persists Contact Technical Support for investigation.
	Poll timeout with INS session	Possible operational error for Summit WM series Spy feature.	Determine if outage was caused by configuration change to Summit WM series Spy feature (add/Remove of controllers from Scan Domain). Determine if outage was caused by network path interruption. If interruption was caused by failure of INS controller, please review the log of that controller to determine appropriate action.
	Connection with INS is up	Link with INS state (Summit WM series Spy)	None
	Connection with INS is down	Possible operational error for Summit WM series Spy feature.	Determine if outage was caused by configuration change to Summit WM series Spy feature (add/Remove of controllers from Scan Domain). Determine if outage was caused by network path interruption. If interruption was caused by failure of INS controller, please review the log of that controller to determine appropriate action.

Table 47: RF_DATA_COLLECTOR (36) logs and events (Continued)

Log ID	Log Message	Comment	Action
Trace			
129	%s.		
130	Error details: %s.		

REMOTE_INS (58)

Table 48: REMOTE_INS (58) logs and events

Log ID	Log Message	Comment	Action
Critical			
1	Rogue AP found by AP%s (SN%s) for scan%s (ID%d) on%s with unknown bssType%u	Scan Result indication	Take appropriate remedial action to identify and neutralize threat.
	Threat [Inactive AP with valid SSID] detected by AP%s, SN%s (%s). Details: RSSI:%u, scanned channel:%u, channel_rx:%u, bssid:%s, ssid:%s, privacy:%s, bssType:%s, beaconInterval:%dms	Scan Result indication	Take appropriate remedial action to identify and neutralize threat.
	Threat [Unknown AP with invalid SSID] detected by AP%s, SN%s (%s). Details: RSSI:%u, scanned channel:%u, channel_rx:%u, bssid:%s, ssid:%s, privacy:%s, bssType:%s, beaconInterval:%dms	Scan Result indication	Take appropriate remedial action to identify and neutralize threat.
	Threat [Known AP with valid SSID] detected by AP%s, SN%s (%s). Details: RSSI:%u, scanned channel:%u, channel_rx:%u, bssid:%s, ssid:%s, privacy:%s, bssType:%s, beaconInterval:%dms	Scan Result indication	Take appropriate remedial action to identify and neutralize threat.
	Unable to malloc memory.	Internal operation error. May indicate a larger problem with system's memory resource management.	If problem persists Contact Technical Support for investigation.
	Malloc failed	Internal operation error. May indicate a larger problem with system's memory resource management.	If problem persists Contact Technical Support for investigation.
	Unable to initialize semaphores	Internal operation error. May indicate a larger problem with system's memory resource management.	If problem persists Contact Technical Support for investigation.

Table 48: REMOTE_INS (58) logs and events (Continued)

Log ID	Log Message	Comment	Action
	Unable to initialize signal handlers	Internal operation error. May indicate a larger problem with system's memory resource management.	If problem persists Contact Technical Support for investigation.
	Unable to initialize internal configuration data structures	Internal operation error. May indicate a larger problem with system's memory resource management.	If problem persists Contact Technical Support for investigation.
	Unable to initialize global log bitmask	Internal operation error. May indicate a larger problem with system's memory resource management.	If problem persists Contact Technical Support for investigation.
Major			
9	%s		
	Threat [Known AP with invalid SSID] detected by AP%s, SN%s (%s). Details: RSSI:%u, scanned channel:%u, channel_rx:%u, bssid:%s, ssid:%s, privacy:%s, bssType:%s, beaconInterval:%dms	Scan Result indication	Take appropriate remedial action to identify and neutralize threat.
	Threat [Device in ad-hoc mode] detected by AP%s, SN%s (%s). Details: RSSI:%u, scanned channel:%u, channel_rx:%u, bssid:%s, ssid:%s, privacy:%s, bssType:%s, beaconInterval:%dms	Scan Result indication	Take appropriate remedial action to identify and neutralize threat.
	Error in analysis_threads: empty command arguments. Thread will exit	Internal operation error. Thread exist shall cause component to terminate and be automatically started by system's health monitor facility. Situation should repair itself.	If problem persists Contact Technical Support for investigation.
	Error in analysis_thread: failed to connect to db message queue. Thread will exit	Internal operation error. Thread exist shall cause component to terminate and be automatically started by system's health monitor facility. Situation should repair itself.	If problem persists Contact Technical Support for investigation.
	Error in setting up RFDC connection: cannot initialize pthread attributes. Connection cannot be setup.	Internal operation error. Problem may prevent Rogue AP (Summit WM series Spy) detection from taking place. Component may need to be restarted.	If problem persists Contact Technical Support for investigation.
	Error in setting up RFDC connection: cannot set detached pthread attributes. Connection cannot be setup.	Internal operation error. Problem may prevent Rogue AP (Summit WM series Spy) detection from taking place. Component may need to be restarted.	If problem persists Contact Technical Support for investigation.

Table 48: REMOTE_INS (58) logs and events (Continued)

Log ID	Log Message	Comment	Action
	Error in setting up RFDC connection: Cannot save client session information into memory. Connection cannot be setup.	Internal operation error. Problem may prevent Rogue AP (Summit WM series Spy) detection from taking place. Component may need to be restarted.	If problem persists Contact Technical Support for investigation.
	Unable to setup RFDC connection	Internal operation error. Problem may prevent Rogue AP (Summit WM series Spy) detection from taking place. Component may need to be restarted.	If problem persists Contact Technical Support for investigation.
	Error in deleting RFDC connection: Cannot delete client information. Will try to tear down connection.	Internal operation error. Failure to delete peer from monitor list should not affect state of feature. Rogue AP detection should be able to proceed.	If problem persists Contact Technical Support for investigation.
	Unable to signal RFDC connection to shutdown.	Internal operation error. Failure to delete peer from monitor list should not affect state of feature. Rogue AP detection should be able to proceed.	If problem persists Contact Technical Support for investigation.
	Error in db_thread: empty command arguments. Thread will exit	Internal operation error. Failure to delete peer from monitor list should not affect state of feature. Rogue AP detection should be able to proceed.	If problem persists Contact Technical Support for investigation.
	Error in db_thread: cannot connect to Database. Thread will exit	Internal operation error. Failure to delete peer from monitor list should not affect state of feature. Rogue AP detection should be able to proceed.	If problem persists Contact Technical Support for investigation.
	Error in db_thread: Failed to create db message queue. Thread will exit	Internal operation error. Failure to delete peer from monitor list should not affect state of feature. Rogue AP detection should be able to proceed.	If problem persists Contact Technical Support for investigation.
	Malloc failed	Internal operation error. Failure to delete peer from monitor list should not affect state of feature. Rogue AP detection should be able to proceed.	If problem persists Contact Technical Support for investigation.
	Error: Failed to connect to analysis message queue. Thread will exit	Internal operation error. Failure to delete peer from monitor list should not affect state of feature. Rogue AP detection should be able to proceed.	If problem persists Contact Technical Support for investigation.
Minor			
33	In run_analysis_against_specific_list: cleanup_memory_for_data for AP failed.	Internal operation issue. May result in problems with memory management for the system.	If problem persists Contact Technical Support for investigation.

Table 48: REMOTE_INS (58) logs and events (Continued)

Log ID	Log Message	Comment	Action
	In run_analysis_against_specific_list: cleanup_memory_for_data for THIRD_PAP failed.	Internal operation issue. May result in problems with memory management for the system.	If problem persists Contact Technical Support for investigation.
	In run_analysis_against_specific_list: cleanup_memory_for_data for FRIENDLY_AP failed.	Internal operation issue. May result in problems with memory management for the system.	If problem persists Contact Technical Support for investigation.
	Unable to cleanup memory for AP information. Memory leak may occur	Internal operation issue. May result in problems with memory management for the system.	If problem persists Contact Technical Support for investigation.
	Unable to cleanup memory for 3rd party information. Memory leak may occur	Internal operation issue. May result in problems with memory management for the system.	If problem persists Contact Technical Support for investigation.
	Unable to cleanup memory for friendly AP party information. Memory leak may occur	Internal operation issue. May result in problems with memory management for the system.	If problem persists Contact Technical Support for investigation.
	Unable to cleanup memory for RF Data Collector connection information. Memory leak may occur	Internal operation issue. May result in problems with memory management for the system.	If problem persists Contact Technical Support for investigation.
	Unable to cleanup memory for Scan group information. Memory leak may occur	Internal operation issue. May result in problems with memory management for the system.	If problem persists Contact Technical Support for investigation.
	Cannot change scan parameters or list of APs when scan is in progress. Scan update failed.	Operational error. Operator can't change parameters for a running scan. Scan must first be stopped and then modified.	None
	Unable to determine time when scan results received from RFDC. Cannot process results and will have to drop them.	Internal operational issue. May result in failure to identify possible threat.	If problem persists Contact Technical Support for investigation.
Info			
65	Sending Scan Request with req_id zero	Summit WM series Spy feature state	None
	Received RFDC Shutdown notify message for RFDC session with ip addr%s	Summit WM series Spy feature state	None
	Received RFDC Shutdown notify message for RFDC session (id =%d)	Summit WM series Spy feature state. Explicit shutdown indicates result of administrative action (Disable feature/Role, system shutdown)	None
	Received request from CM to delete RFDC session (id =%d). Cannot process this request.	Internal operating issue. Possible configuration mismatch. Deletion however should have no impact on running detection scans.	If problem persists Contact Technical Support for investigation.
	Received request from CM to delete RFDC session with ip addr%s	Summit WM series Spy feature state	None
	Connection with RFDC session with ip addr%s is up	Summit WM series Spy feature state	None

Table 48: REMOTE_INS (58) logs and events (Continued)

Log ID	Log Message	Comment	Action
	Connection with RFDC session (id =%d) is up	Summit WM series Spy feature state	None
	Connection with AC for RFDC session with ip addr%s is down	Possible Feature Impact. Scanning peer may not be available to report information.	Determine if outage was caused by configuration change to Summit WM series Spy feature (add/Remove of controllers from Scan Domain). Determine if outage was caused by network path interruption. If interruption was caused by failure of INS controller, please review.
	Connection with AC for RFDC session (id =%d) is down	Possible Feature Impact. Scanning peer may not be available to report information.	Determine if outage was caused by configuration change to Summit WM series Spy feature (add/Remove of controllers from Scan Domain). Determine if outage was caused by network path interruption. If interruption was caused by failure of INS controller, please review.
	Connection with AC for RFDC session with ip addr%s is up	Summit WM series Spy feature state	None
	Connection with AC for RFDC session (id =%d) is up	Summit WM series Spy feature state	None
	Connection with RFDC session with ip addr%s is lost due to poll timeout.	Possible Feature Impact. Scanning peer may not be available to report information.	Determine if outage was caused by configuration change to Summit WM series Spy feature (add/Remove of controllers from Scan Domain). Determine if outage was caused by network path interruption. If interruption was caused by failure of INS controller, please review.
	Connection with RFDC session (id =%d) lost due to poll timeout.	Possible Feature Impact. Scanning peer may not be available to report information.	Determine if outage was caused by configuration change to Summit WM series Spy feature (add/Remove of controllers from Scan Domain). Determine if outage was caused by network path interruption. If interruption was caused by failure of INS controller, please review.
Trace			
129	%s		
130	%s		

LLC_HANDLER (62)

Table 49: LLC_HANDLER (62) logs and events

Log ID	Log Message	Comment	Action
Critical			
1	Malloc failed	Internal operation error. May indicate a larger problem with system's memory resource management.	If problem persists Contact Technical Support for investigation.
	Unable to initialize semaphores	Internal operation error. May indicate a larger problem with system's memory resource management.	If problem persists Contact Technical Support for investigation.
	Unable to initialize signal handlers	Internal operation error. May indicate a larger problem with system's memory resource management.	If problem persists Contact Technical Support for investigation.
	Unable to initialize global log bitmask	Internal operation error. May indicate a larger problem with system's memory resource management.	If problem persists Contact Technical Support for investigation.
	Unable to initialize internal configuration data structures	Internal operation error. May indicate a larger problem with system's memory resource management.	If problem persists Contact Technical Support for investigation.
Major			
9	Error in main: Cannot determine langley connection options. Exit	Internal communications issue. Possible misconfiguration of internal settings. Exiting should cause component to be restarted by system's health monitoring framework.	If problem persists Contact Technical Support for investigation.
	Error in main: Cannot determine langley connection subscriptions. Exit	Internal communications issue. Possible misconfiguration of internal settings. Exiting should cause component to be restarted by system's health monitoring framework.	If problem persists Contact Technical Support for investigation.
	Malloc failed	Internal operation error. May indicate a larger problem with system's memory resource management.	If problem persists Contact Technical Support for investigation.
	Error in llc_packet_thread: empty command arguments. Thread will exit	Internal operation error. Thread exist shall cause component to terminate and be automatically started by system's health monitor facility. Situation should repair itself.	If problem persists Contact Technical Support for investigation.
	Error in llc_packet_thread: Cannot determine langley connection options. Thread will exit	Internal operation error. Thread exist shall cause component to terminate and be automatically started by system's health monitor facility. Situation should repair itself.	If problem persists Contact Technical Support for investigation.

Table 49: LLC_HANDLER (62) logs and events (Continued)

Log ID	Log Message	Comment	Action
	Error in llc_packet_thread: Cannot determine langley connection subscriptions. Thread will exit	Internal operation error. Thread exist shall cause component to terminate and be automatically started by system's health monitor facility. Situation should repair itself.	If problem persists Contact Technical Support for investigation.
	Error in initialize_tlv_dictionary: empty command arguments: cannot get tlv dictionary path	Internal operation error. Thread exist shall cause component to terminate and be automatically started by system's health monitor facility. Situation should repair itself.	If problem persists Contact Technical Support for investigation.
Minor			
33	Unable to cleanup 3PAP information. Memory leak may occur	Internal operation issue. May result in problems with memory management for the system.	If problem persists Contact Technical Support for investigation.
	In determine_whether_mac_address_is_a_3pap: cleanup_memory_for_data for THIRD_PAP failed	Internal operation issue. May result in problems with memory management for the system.	If problem persists Contact Technical Support for investigation.
	In determine_whether_mac_address_is_a_bp: cleanup_memory_for_data for BP failed.	Internal operation issue. May result in problems with memory management for the system.	If problem persists Contact Technical Support for investigation.
Trace			
129	%s.		
130	Error: %s.		

RADIUS_ACCOUNTING (64)

Table 50: RADIUS_ACCOUNTING (64) logs and events

Log ID	Log Message	Comment	Action
Critical			
1	No Response from all RADIUS accounting server(s):%s.	Possible issue with configuration of CDR/ Accounting sub-system. Can result in lack of accounting reporting/CDR for system users. Doesn't affect users state, however, it doesn't allow owner to provide proper billing for services rendered.	Validate configuration of CDR/ Accounting settings for Radius Server and WM-AD definitions. If problem persists contact Technical Support to investigate.
Major			

Table 50: RADIUS_ACCOUNTING (64) logs and events (Continued)

Log ID	Log Message	Comment	Action
9	No Response from one RADIUS accounting server:%s.	Possible issue with configuration of CDR/ Accounting sub-system. Can result in lack of accounting reporting/CDR for system users. Doesn't affect users state, however, it doesn't allow owner to provide proper billing for services rendered. If backup/alternate servers were defined system will attempt to connect to them.	Validate configuration of CDR/ Accounting settings for Radius Server and WM-AD definitions. If problem persists contact Technical Support to investigate.
Trace			
129	%s		

RU_SESMGR_ID (65)

Table 51: RU_SESMGR_ID (65) logs and events

Log ID	Log Message	Comment	Action
Major			
9	Loss of active mobility tunnel with Peer%s detected. Please verify reachability. System will reattempt connection.	Possible Feature Impact. Some possible user impact as tunnel change purges sessions associated with peer. Users if connected will need to re-authenticate and renegotiate topology profile.	Determine if outage was caused by configuration change to Mobility feature (add/Remove of controllers from Mobility Domain). Determine if outage was caused by network path interruption. If interruption was caused by failure of Mobility controller, please review log file to determine appropriate root cause and corresponding action.
Minor			
33	Successfully established mobility tunnel with peer%s.	Inter-AC Mobility State	None
34	Mobility tunnel with Peer%s reset due to membership credentials change.	Inter-AC Mobility State. Administrator changed mobility domain membership list.	None
35	Mobility tunnels with Peers reset due to membership credentials change on current controller.	Inter-AC Mobility State. Administrator changed mobility domain membership list.	None

Table 51: RU_SESMGR_ID (65) logs and events (Continued)

Log ID	Log Message	Comment	Action
36	Mobility tunnel establishment failed with Peer%s. Please verify peer's reachability.	Possible Feature Impact. Some possible user impact as tunnel change purges sessions associated with peer. Users if connected will need to re-authenticate and renegotiate topology profile.	Determine if outage was caused by configuration change to Mobility feature (add/Remove of controllers from Mobility Domain). Determine if outage was caused by network path interruption. If interruption was caused by failure of Mobility controller, please review log file to determine appropriate root cause and corresponding action
37	Mobility manager startup.	Component state	None
38	RU Session Manager startup.	Component state	None
Info			
65	Access point registration and authentication succeeded. (%S.)	Access Controller registration state	None
66	Access point registration and/ or authentication failed. (%S.)	Access Controller registration failed. AP unsuccessful in establishing credential exchange with controller. AP will retry.	If problem persists Contact Technical Support for investigation.
67	Access point session poll disconnect AP session timed out. (%S.)	AP disconnected from active controller. May no longer be available for RF coverage.	Determine if outage was caused by configuration change (Delete/Pending/ Release). Determine if outage was caused by network path interruption. If interruption was caused by functional issue with AP or controller please contact Technical Support to investigate.
68	Access controller tunnel registration failed (%s).	Possible Feature Impact. Some possible user impact as tunnel change purges sessions associated with peer. Users if connected will need to re-authenticate and renegotiate topology profile.	Determine if outage was caused by configuration change to Mobility feature (add/Remove of controllers from Mobility Domain). Determine if outage was caused by network path interruption. If interruption was caused by failure of Mobility controller, please review log file to determine appropriate root cause and corresponding action.
69	Access point software version validation failed. (%s)	AP was determined to not be running an adequate firmware version for operation with controller. May be result of administration specification of firmware upgrade request.	Validate version incompatibility of AP. Verify that correct upgrade image is available. Upgrade will take place automatically.
70	%s transmission failed.	Interprocess communication failure between AP and controller.	If problem persists Contact Technical Support for investigation.

Table 51: RU_SESMGR_ID (65) logs and events (Continued)

Log ID	Log Message	Comment	Action
Trace			
130	%s		

MU_SESMGR_ID (66)

Table 52: MU_SESMGR_ID (66) logs and events

Log ID	Log Message	Comment	Action
Minor			
33	Maximum number of home sessions has been reached. No more home users will be permitted.	Reached maximum user capacity for system. Need to deploy additional controllers to take on excessive capacity.	Contact Sales support to discuss expanding deployment.
34	Maximum number of visiting sessions has been reached. No more visiting users will be permitted.	Reached maximum user capacity for system. Need to deploy additional controllers to take on excessive capacity.	Contact Sales support to discuss expanding deployment.
Info			
65	Client session registration succeeded (%s)	New user joined coverage domain.	None
66	Client session registration failed (%s) Idle timeout.	No activity has been seen from user session by threshold time. Session terminated under assumption that user roamed away from coverage domain.	None
67	Client session de-registration succeeded (%s) Reason is: Idle timeout.	No activity has been seen from user session by threshold time. Session terminated under assumption that user roamed away from coverage domain.	None
69	Client session state changed (%s)	Authentication, administrative or remote interface has changed the state of a particular user.	None
71	Client session de-registration succeeded (%s) Reason is: Idle timeout.	No activity has been seen from user session by threshold time. Session terminated under assumption that user roamed away from coverage domain.	None
72	Client session de-registration succeeded (%s) Reason is: RF Disconnected.	User requested disconnection from mobility domain (Captive Portal).	None
73	Client session de-registration succeeded (%s) Reason is: Administrator request from GUI.	Administration request to user de-registration.	None
74	Client session de-registration succeeded (%s) Reason is: Request from Other BM.	Administration/Policy request to user de-registration.	None

Table 52: MU_SESMGR_ID (66) logs and events (Continued)

Log ID	Log Message	Comment	Action
75	Client session de-registration succeeded (%s) Reason is: Resync cleanup.	Policy request to user de-registration.	None
76	Client session de-registration succeeded (%s) Reason is: Session roam away.	Policy/Mobility request to user de-registration.	None
77	Client session de-registration succeeded (%s) Reason is: Life time session time out.	Policy request to user de-registration.	None
78	Client session de-registration succeeded (%s) Reason is: Tunnel Disconnect.	Policy/Mobility request to user de-registration.	None
79	Client session de-registration succeeded (%s) Reason is: User request.	User requested disconnection from mobility domain (Captive Portal).	None
80	Client session de-registration succeeded (%s) Reason is: Mobility Manager request.	Policy/Mobility request to user de-registration.	None
83	Client session de-registration succeeded (%s) Reason is: User changing subnet.	Policy request to user de-registration.	None

FILTER_MGR_ID (67)

Table 53: FILTER_MGR_ID (67) logs and events

Log ID	Log Message	Comment	Action
Critical			
1	Connection to messaging bus failed - reason [%d]. Filter Manager shutdown!!!	Internal operation error. Connection will be re-attempted.	If problem persists Contact Technical Support for investigation.
Major			
9	Unknown filter ID [%d] to be sent to FE.	Possible configuration issue. Unknown configuration element may cause operational issues.	If problem persists Contact Technical Support for investigation.
10	Number of rules per filter ID [%d] exceeds the limit.	Limits enforcement. Possible that some of the intended filter rules for a definition have not been persisted.	Revisit rule definition to determine effectiveness of existing definitions and identify set of rules to possible delete to create additional space
11	Total number of rules exceeds the limit [%d].	Limits enforcement. Possible that some of the intended filter rules for a definition have not been persisted.	Revisit rule definition to determine effectiveness of existing definitions and identify set of rules to possible delete to create additional space

Table 53: FILTER_MGR_ID (67) logs and events (Continued)

Log ID	Log Message	Comment	Action
12	No rules defined for this filter ID [%d].	Internal Error Condition. Filers are defined by default with at least 1 rule (Deny All). This condition should never occur.	If problem persists Contact Technical Support for investigation.
13	Filter rules response returned NACK. Error code [%d].	Internal operation failure. Failed to obtain a set of filter rules from the systems provisioning system. Component will retry.	If problem persists Contact Technical Support for investigation.
14	FE is not responding - error [%d].	Failed to communicate with FE during provisioning or stats collection information. Filtering system will reset.	If problem persists Contact Technical Support for investigation.
15	Configuring wrong filter ID [%d].	Internal operation error in processing a Filter group. Possible misconfiguration problem. Filtering sub-system will retry.	If problem persists Contact Technical Support for investigation.
16	Property array is NULL for the received message [%d].	Internal operation failure.Flter sub-system will retry.	If problem persists Contact Technical Support for investigation.
17	Failed to send message [%d].	Internal operation failure. Filter sub-system will retry	If problem persists Contact Technical Support for investigation.
18	Filter params is NULL for message [%d].	Internal operation failure. Filter sub-system will retry	If problem persists Contact Technical Support for investigation.
19	Failed to initialize list for message [%d].	Internal operation failure. Filter sub-system will retry	If problem persists Contact Technical Support for investigation.
20	Timer initialization failed - error [%d].	Internal operation failure. Filter requests may not follow proper timeout values. Component may require reset.	If problem persists Contact Technical Support for investigation.
21	Filter purge response returned NACK - error [%d].	Internal operation error. Failure to reset FE filter table. FE may be operating with incorrect filter set.	If problem persists Contact Technical Support for investigation.
22	Unknown rule index [%d].	Internal operation failure. Filter sub-system will retry	If problem persists Contact Technical Support for investigation.
23	Filter add response returned NACK - error [%d].	Internal operation failure. Filter sub-system will retry	If problem persists Contact Technical Support for investigation.
24	Filter delete response returned NACK - error [%d].	Internal operation failure. Filter sub-system will retry	If problem persists Contact Technical Support for investigation.
25	Filter stats response returned NACK - error [%d].	Internal operation failure. Filter sub-system will retry	If problem persists Contact Technical Support for investigation.

Table 53: FILTER_MGR_ID (67) logs and events (Continued)

Log ID	Log Message	Comment	Action
26	No FE mode was set [%d].	Failed to resolve type of FE on system. Possible impact to filtering subsystem behaviour. Filters may not be properly installed in FE	If problem persists Contact Technical Support for investigation.
27	Unknown filter ID [%d] in the update response.	Internal operation failure. Filter sub-system will retry	If problem persists Contact Technical Support for investigation.
28	Unknown filter ID [%d] in the update notify.	Internal operation failure. Filter sub-system will retry	If problem persists Contact Technical Support for investigation.
29	Unknown filter ID [%d] in the rules response.	Internal operation failure. Filter sub-system will retry	If problem persists Contact Technical Support for investigation.
30	Filter ID mismatch [%d] in the FE filter add operation.	Internal operation failure. Filter sub-system will retry	If problem persists Contact Technical Support for investigation.
Minor			
33	Failed to receive message - reason [%d].	Internal operation failure. Filter sub-system will retry	If problem persists Contact Technical Support for investigation.
34	Failed to process message [%d].	Internal operation failure. Filter sub-system will retry	If problem persists Contact Technical Support for investigation.
35	Unknown message type [%d].	Internal operation failure. Filter sub-system will retry	If problem persists Contact Technical Support for investigation.
36	Rules request timer has expired.	Failure to obtain response to filter provisioning operation. Filter sub-system will retry.	If problem persists Contact Technical Support for investigation.
37	FE add request timer has expired.	Failure to obtain response to filter provisioning operation to FE. Filter sub-system will retry.	If problem persists Contact Technical Support for investigation.
38	FE stats request timer has expired.	Failure to obtain response for stats request from FE. Request will be retried. No direct impact to Filtering operation.	If problem persists Contact Technical Support for investigation.
39	FE is up.	FE State is active.	None
40	FE is down.	Lost connection to FE. System operations will be severely affected. FE failure will likely cause service interruption.	If problem persists Contact Technical Support for investigation.
41	FE purge request timer has expired.	Failure to obtain response to filter provisioning operation to FE. Filter sub-system will retry.	If problem persists Contact Technical Support for investigation.
42	FE delete request timer has expired.	Failure to obtain response to filter provisioning operation to FE. Filter sub-system will retry.	If problem persists Contact Technical Support for investigation.

REDIRECTOR4 (68)

Table 54: REDIRECTOR4 (68) logs and events

Log ID	Log Message	Comment	Action
Critical			
1	Got a bad token from secMgr for%s	Failed to obtain credential abstraction for captive portal redirection. Redirection operation will fail for that operation. Client will most likely restart.	If problem persists Contact Technical Support for investigation.
2	Client%s is in an infinite loop!	Detected possible issue with Client behaviour on redirection.	Verify that ""Non-Authenticated"" filter rules for ""WM-AD"" are properly defined to allow access to target authentication server. Filter failure may result in continuous redirection. If no configuration issue is identified Contact Technical Support to investigate.
3	Cannot grok the MAC address for%s, ignoring request	Failed to identify session being redirected. Typically client will be retried.	If problem persists Contact Technical Support for investigation.
4	Cannot get a token from secMgr for%s (Langley communication timeout?)	Failed to obtain credential abstraction for captive portal redirection. Redirection operation will fail for that operation. Client will most likely restart.	If problem persists Contact Technical Support for investigation.
5	Cannot grok a URL for%s (Langley communication timeout?)	Failed to identify the URL to which a user session should be redirected to. Possible issue with configuration of WM-AD captive portal settings.	If problem persists Contact Technical Support for investigation.
6	Cannot grok a URL for%s (MU_S_MGR error)	Failed to identify the URL to which a user session should be redirected to. Possible issue with configuration of WM-AD captive portal settings.	If problem persists Contact Technical Support for investigation.
8	Internal error	Internal component error. Typical clients will retry operation.	If problem persists Contact Technical Support for investigation.

BEAST (75)

Table 55: BEAST (75) logs and events

Log ID	Log Message	Comment	Action
Critical			

Table 55: BEAST (75) logs and events (Continued)

Log ID	Log Message	Comment	Action
1	Failed to receive CIA message.	Internal communication operation.	If problem persists Contact Technical Support for investigation.
2	Unable to connect to database.	Failed to interface with provisioning system. Will affect report generation.	If problem persists Contact Technical Support for investigation.
3	Failed to initialize the input queue.	Internal operational issue. May result in failure to generate proper reports. Component may need to be reset.	If problem persists Contact Technical Support for investigation.
4	Failed to initialize the output queue.	Internal operational issue. May result in failure to generate proper reports. Component may need to be reset.	If problem persists Contact Technical Support for investigation.
Major			
9	Unable to create thread for polling MU Session Manager.	Internal operational issue. May result in failure to generate proper reports. Component may need to be reset.	If problem persists Contact Technical Support for investigation.
10	Unable to create thread for polling RU Session Manager.	Internal operational issue. May result in failure to generate proper reports. Component may need to be reset.	If problem persists Contact Technical Support for investigation.
11	Unable to create thread for polling Mobility Manager.	Internal operational issue. May result in failure to generate proper reports. Component may need to be reset.	If problem persists Contact Technical Support for investigation.
12	Unable to create thread for polling Port Info Manager.	Internal operational issue. May result in failure to generate proper reports. Component may need to be reset.	If problem persists Contact Technical Support for investigation.
13	Unable to create thread for polling Filter Manager.	Internal operational issue. May result in failure to generate proper reports. Component may need to be reset.	If problem persists Contact Technical Support for investigation.
14	Unable to create thread for polling AP SNMP stats.	Internal operational issue. May result in failure to generate proper reports. Component may need to be reset.	If problem persists Contact Technical Support for investigation.
15	Unable to create thread for polling DAS stats.	Internal operational issue. May result in failure to generate proper reports. Component may need to be reset.	If problem persists Contact Technical Support for investigation.
16	Unable to create thread for polling RADIUS stats.	Internal operational issue. May result in failure to generate proper reports. Component may need to be reset.	If problem persists Contact Technical Support for investigation.
Minor			
33	Failed to send statistics request for AP serial number:%s.	Failure to communicate with a specific AP for the purpose of retrieving RF statistics. Request will be retried.	If problem persists Contact Technical Support for investigation.

Table 55: BEAST (75) logs and events (Continued)

Log ID	Log Message	Comment	Action
34	Failed to process CIA message:%d.	Internal communication issue.	If problem persists Contact Technical Support for investigation.
Info			
65	Received unexpected CIA message:%d.	Internal communication issue.	If problem persists Contact Technical Support for investigation.
66	Received message [%d] whose payload is NULL.	Internal communication issue.	If problem persists Contact Technical Support for investigation.
67	Shut down Access Controller Statistician.	Statistics server is terminating. Reports will not be generated. User accounting may also be affected.	If problem persists Contact Technical Support for investigation.
Trace			
129	Received CIA message: %d.		
130	Starting polling threads.		

BEACONPOINT (99)

Table 56: BEACONPOINT (99) logs and events

Log ID	Log Message	Comment	Action
Critical			
1	%s	Beacon Point Log Ids come from its own log dictionary.	n/a

FILTER_MANAGER_ID (103)

Table 57: FILTER_MANAGER_ID (103)logs and events

Log ID	Log Message	Comment	Action
Info			
65	Filter Manager configuration complete - all filter parameters have been resolved.	Notification of completion of pushing filtering policy to FE.	None

REDIR_ID (106)

Table 58: REDIR_ID (106) logs and events

Log ID	Log Message	Comment	Action
Major			
9	Redirect packet is too big, packet will be dropped (%s)	Redirector packet exceeds maximum available buffer.	None

CPDP_AGENT_ID (110)

Table 59: CPDP_AGENT_ID (110) logs and events

Log ID	Log Message	Comment	Action
Major			
9	Possible LAND DoS attack (%s).	Possible Denial of Service attack.	Investigate attach characteristics. Identify source and determine best cause of action to remedy problem.
10	Possible PING-OF-DEATH DoS attack (%s).	Possible Denial of Service attack.	Investigate attach characteristics. Identify source and determine best cause of action to remedy problem.
Info			
67	CPDP thread connection reset.	Connection between FE and Management plane lost. Connection will be re-attempted and communication restored.	If problem persists Contact Technical Support for investigation.

PORT_INFO_J_MANAGER (118)

Table 60: PORT_INFO_J_MANAGER (118) logs and events

Log ID	Log Message	Comment	Action
Major			
9	Next hop device is unreachable (%s)	Next hop overwrite for WM-AD is not resolved. May be possible result of misconfiguration.	If problem persists Contact Technical Support for investigation.
Info			
65	Next hop device is reachable again (%s)	Next hop resolution state.	None

ECHELON (126)

Table 61: ECHELON (126) logs and events

Log ID	Log Message	Comment	Action
Critical			
1	FE Link is down.	Link to the FE is lost. System will reboot to reset full system.	If problem persists Contact Technical Support for investigation.
Major			
9	FE Link is up.	FE is ready to start receiving provisioning configuration from MP and to begin providing data services.	None

19 Reference lists of standards

RFC list

This section provides the Internet Engineering Task Force (IETF) Request for Comments (RFCs) standards supported by Summit WM Controller, Access Points, and WM software.

The Request for Comments is a series of notes about the Internet, submitted to the Internet Engineering Task Force (IETF) and designated by an RFC number, that may evolve into an Internet standard. The RFCs are catalogued and maintained on the IETF RFC website: www.ietf.org/rfc.html.

Table 62: List of RFCs

RFC Number	Title
RFC 791	IPv4
RFC 1812	Minimum Router Requirements
RFC 793	Transport Control Protocol (TCP)
RFC 768	User Datagram Protocol (UDP)
RFC 792	Internet Control Message Protocol (ICMP)
RFC 826	Address Resolution Protocol (ARP)
RFC 2865	Remote Access Dial In User Service (RADIUS)
RFC 2866	RADIUS Accounting
RFC 2165, 2608	Service Location Protocol (SLP)
RFC 2131	Dynamic Host Configuration Protocol (DHCP)
RFC 2328	Open Shortest Path First (OSPF v2)
RFC 1587	OSPF Not So Stubby Area (NSSA) Option
RFC1350:	The TFTP Protocol (Revision 2)
RFC 2716	EAP-TLS
RFC 1155	Structure and identification of management information for TCP/IP-based Internets.
RFC 1157	Simple Network Management Protocol (SNMP).
RFC 1212	Concise MIB definitions.
RFC 1213	Management Information Base for Network Management of TCP/IP-based Internets MIB-II.
RFC 1215	Convention for defining traps for use with the SNMP.
RFC 1901	Introduction to Community-based SNMPv2 (SNMPv2c).
RFC 2011	SNMPv2 Management Information Base for the Internet Protocol using SMIv2.
RFC 2012	SNMPv2 Management Information Base for the Transmission Control Protocol using SMIv2.
RFC 2013	SNMPv2 Management Information Base for the User Datagram Protocol using SMIv2.
RFC 2578	Structure of Management Information Version 2 (SMIv2).
RFC 2579	Textual Conventions for SMIv2. 2580 Conformance Statements for SMIv2.
RFC 2863	The Interfaces Group MIB.
RFC 3416	Version 2 of the Protocol Operations for the Simple Network Management Protocol (SNMP)
RFC 3417	Transport Mappings for the Simple Network Management Protocol (SNMP).

Table 62: List of RFCs (Continued)

RFC Number	Title
RFC 3418	Management Information Base (MIB) for the Simple Network Management Protocol (SNMP).
RFC 3576	Dynamic Authentication Extensions to RADIUS
RFC 959	File Transfer Protocol. (FTP)
RFC 2660	The Secure HyperText Transfer Protocol (HTTPS)
RFC 2030	Simple Network Time Protocol v4
RFC 1191	Path MTU Discovery
Internet Draft	Secure Shell v2 (SSHv2)
Internet Draft	EAP-TTLS
Internet Draft	EAP-PEAP
Internet Draft	CAPWAP Tunneling Protocol (CTP)

802.11 standards list

The following 802.11 standards are also supported:

Table 63: List of 802.11 standards supported

Standard	Name	
802.11	Wireless LAN MAC and PHY Specifications	
802.11a	Wireless LAN	High Speed Physical Layer in 5 GHz band
802.11b	Wireless LAN	High Speed Physical Layer in 2.4 GHz band
802.11d	802.11 Extensions to Operate in Additional Regulatory Domains	
802.11e	MAC Enhancements for Quality of Service	
802.11g	Wireless LAN	Further High Data Rate Extensions in 2.4 GHz band
802.11h	Spectrum managed 802.11a (in 5 GHz band in Europe)	
802.11i	WLAN security and provide better network access control	
802.1X	Port based network access control	
802.1aa	802.1X maintenance	
802.3af	DTE Power via MDI (Power over Ethernet)	
802.3	CSMA/CD (Ethernet)	
802.3i	10Base-T	
802.3u	100Base-T	
802.3x	Full Duplex	
802.3z	1000Base-X (Gigabit Ethernet)	
802.1d	MAC bridges	

Table 63: List of 802.11 standards supported (Continued)

Standard	Name	
802.1p		
802.1q	VLANs	
802.11	MIB management information base for 802.11	

Supported Wi-Fi Alliance standards

The following WiFi Alliance standards are supported:

- Standard IEEE
  - IEEE 802.11a
  - IEEE 802.11b
  - IEEE 802.11g
- WPA
  - WPA - Enterprise
  - WPA - Personal
- WPA2
  - WPA2 - Enterprise
  - WPA2 - Personal
- EAP
  - EAP-TLS
  - EAP-TTLS/MSCHAPv2
  - PEAPv0/EAP-MSCHAPv2
  - PEAPv1/EAP-GTC
  - EAP-SIM
- Optional - Quality of Service
  - WMM

Glossary

AAA	Authentication, Authentication, Accounting
ACS	Auto Channel Selection
AP	Access point (also referred to as Altitude AP)
AS	Authentication Server
ATPC	Automatic Tx Power Control
AU	Authentication
Authentication server	Entity that provides an authentication service to an authenticator. Typically, a RADIUS server operates as an authentication server, with RADIUS acting as a transport for EAP from the authenticator to the authentication server.
authenticator	Facilitates the authentication and granting of service to a supplicant. Typically, an authenticator transposes an EAP conversation from supplicant to authentication server. An authenticator is usually an EAP conduit, but is aware of the conversation.
CDR	Call Detail Record
Cell	RF coverage area provided by Altitude AP or an Access Point
CLI	Command Line Interface
CTP	CAPWAP Tunneling Protocol
dB	A ratio of two power levels P1 and P2 expressed on a logarithmic scale 10*log10(P1/P2)
dBm	Power level P expressed as dB vs 1mW, i.e. 10*log10(P/1mW)
DRM	Dynamic Radio Management
EAP	Extensible Authentication Protocol
EAPOL	Extensible Authentication Protocol over LAN. Primarily, IEEE 802.1X is an encapsulation definition for EAP over IEEE 802 media.The key protocol for the transport of an end-to-end EAP conversation via IEEE 802 media between a supplicant and an authenticator.
EAP-PEAP	Remove the burden of client certificates since only the server needs to have a certificate. For client authentication, instead of certificate based, allows an extensible set of authentication such as MD5, CHAP or MS-CHAP v2. Uses EAP-TLS to establish a secure channel before authentication challenge is used.

EAP-TLS	Requires both client and server to authenticate with each other via PKI which can be in the form of X.509 certificates or smart cards. The exchange is done inside a TLS tunnel which makes it resistant to man-in-the-middle attacks. The drawback is that it requires heavy PKI infrastructure to be in place.
ESS	Extended Service Set
ESSID	Extended Service Set Identification
EU	European Union
GUI	Graphical User Interface
ICMP	Internet Control Message Protocol
IEEE	Institute of Electrical and Electronics Engineers
IEEE 802.1X	Authentication standard for port-based access control over any IEEE 802 or PPP media. Used primarily to identify users before allowing their traffic onto the network. IEEE 802.1X is a framework designed to address and provide port-based access control using authentication.
IP	Internet Protocol
ISP	Internet Service Provider
LAN	Local Area Network
MAC	Media Access Control
MIB	Management Information Base
MTU	Maximum Transmission Unit
MU	Mobile User
NAPT	Network Address Translation Protocol
NOC	Network Operations Center
RADIUS	Remote Authentication Dial In User Service
RF	Radio Frequency
ROW	Rest of World
RS	Radio Signal
SLP	Service Location Protocol
SNMP	Simple Network Management Protocol
SNR	Signal-to-Noise Ratio
SSID	Service Set Identifier

supplicant	Usually a laptop or other device that requires authentication or has to access service from a network point of attachment
Tx	Transmit or Transmission
WISP	Wireless ISP
WLAN	Wireless Local Area Network
WM-AD	WM Access Domain

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